James

INDIAN

INDUSTRIES.

BY

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AUTHOR OF

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INTRODUCTION.

INDIA is now so much written about, talked and thought of, that it is possible this book which I have gathered short descriptions of chief industries, may prove of use to those have not leisure to read through lengthy but yet take sufficient interest in the country to wish to know more about its principal sources of revenue. Many have gone over the ground I am now treading, and with less halting pens than mine; in most cases, however, special articles of commercial value, or of general use, have been treated of, such as "Tea," "Coffee," "Silk," "Fibrous Plants," "Useful Plants," and the like; men considered as authorities in these particular branches having given the world the benefit of their individual and practical experience. While striving to combine under the head of "Indian Industries" as much information as possible respecting the numerous sources of India's wealth, I

have availed myself largely of the contents of such books and pamphlets on special subjects as I have been able to procure.

Deeply interested in India myself, I have, since my return from thence—some years ago—collected as much material, from time to time, as I could, on the numerous industries of the country, with a view to showing of what vast natural resources our Eastern Empire is possessed, and how much there yet remains to be done in developing these resources to their full extent. My information I have obtained from well-known books on India, from Indian papers, private sources and my own knowledge of the country—as far as it goes; in all cases in which it was possible, having, I hope, acknowledged my indebtedness.

For the convenience of those using the book for reference, the subjects are arranged, as far as possible, alphabetically.

For sins of omission and commission, I can only crave forgiveness, pleading in excuse, for yet another book on India, my great interest in the country, and in its future well-being. My hope is that some may, from reading "Indian Industries," take a greater interest than they have hitherto done in their development.

My regret is that I have not done my subject greater justice.

Some of the chapters have already ap
the *British Mercantile Gazette*; these,
courtesy of the proprietors of that journal,
allowed to reprint. They are those on "
"Cotton," "Gold," "Indigo," "Iron," "
"Rice," "Salt," "Sugar," and "Tea;" but
instance they have been considerably enlar
some entirely rewritten.

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entitled "Agricultural Reform in India" should be read and studied by all to whom this subject is one of interest; it is to be hoped that it will secure the attention it deserves. The author's opinion is, that in only one way can a thorough reform in the present system of Indian agriculture be effected, that way being by the establishment, as soon as possible, of a "real working Agricultural Department," to be presided over by a Director General, supervised in every province by provincial directors, supplied liberally with money, agricultural implements, and experts thoroughly qualified to attend to each individual branch of agriculture; so that the result may be, as far as possible, one perfect system throughout the country.

If an agricultural department such as Mr. Hume has briefly sketched out is to do any real good and confer lasting benefit on the vast number of Indian agriculturists, it must be managed on thoroughly practical lines. Those connected with it should have, as Lord Mayo had, a practical knowledge of farming, and agricultural business in all its widely spread branches; a man who is only *theoretically* acquainted with the subject is not the right man for the post of Director General, nor indeed for a subordinate appointment. If men can be got who have learned from *personal* experience their agricultural knowledge, then those are the men for India; and they are those to whom the improvement of the Indian system must be entrusted if any reliable work is to be done amongst the poorer cultivators. The husbandmen of India are by no means the stupid race some people would lead us to suppose; they are, on the contrary, extremely intelligent, patient, frugal, and decidedly ingenious, this being proved by the wonderful results of their unscientific and ignorant ways of labouring. Considering their want of—in almost every instance—capital, the primi-

tive implements with which they work, [illegible] all proper appliances and machinery, [illegible] they produce off their lands are [illegible]. Their greatest fault is their [illegible] byegone rules,—as their fathers worked [illegible] they are entirely adverse to trying any new [illegible] that is until they see that it is [illegible] tically a good one. It is only by [illegible] good farmers living among them that they [illegible] be brought to see how much more, under [illegible] conditions, is to be made out of their land. They [illegible] a considerable amount of knowledge of [illegible] but they work on steadily in the old groove they have been used to for centuries, as Dr. [illegible] native cultivators. "They know [illegible] (if only meteorological conditions permit) [illegible] staple and each variety of each staple [illegible] their neighbourhood; they know the [illegible] and hedges, [illegible] bouring vermin, and will [illegible] accurately distinguish every [illegible] appreciate the smallest differences [illegible] ties of different soils, as to [illegible] and, so far as the crops [illegible] varying properties and [illegible] realize the value though [illegible] of ordinary manure [illegible] which are most [illegible] know the advantage of [illegible] as their imperfect implements [illegible] permit, and of [illegible] they also recognise [illegible] manure, it would [illegible] part. In [illegible] proper [illegible] Europe. [illegible]

like village site in Upper India and look down on all sides on one wide sea of waving wheat, broken only by dark green islands of mango groves. Many, many square miles of wheat and not a weed or a blade of grass six inches in height to be found amongst it. What is to be spied out creeping here and there on the ground is only the growth of the last few weeks, since the corn grew too high and thick to permit the women and children to continue weeding. They know when to feed down a too forward crop; they know the benefit of and practise, so far as circumstances and poverty permit, a rotation of crops. They are great adepts at storing grain, and will turn it out of rough earthen pits after twenty years absolutely uninjured. They know the exact state of ripeness to which grain should be allowed to stand in different seasons; in other words, under different meteorological conditions to ensure its *keeping* when thus stored; and equally the length of time that, under varying atmospheric conditions it should lie upon the open threshing-floor to secure the same object. Imperfect appliances, superstition, money troubles, and the usurer's impatience, often prevent their practising what they do know; but so far as what may be called non-scientific agriculture is concerned there is little to teach them, and certainly very few European farmers could, fettered by the same conditions as our ryots, produce better if as good crops."

I have quoted Mr. Hume at length on the subject of the Indian cultivator's knowledge, because the idea prevailing in this country is, I know, that the ryots are slovenly farmers, and that their poverty is in a measure owing to this cause. A walk through well-cultivated village land would soon dispel these hastily formed ideas. On my first arrival in India I was much struck with the wonderful *cleanliness* of the land, under crops in particular, and often rode in

the mornings through the tiny paths in the fields of standing corn, and marvelled at the absence of weeds; most certainly do I echo Mr. Ozanne's words, and state that the Indian wheat-fields and other grain-fields would bear comparison with those in England, or any other place, and lose nothing by the contrast. Natives always seem to be weeding gardens or fields; there is a kept look about the land which cannot fail to impress those who take an interest in agriculture. The superstitions and traditions which have been handed down to them govern their actions too often to the detriment of their well-being; they depend too much on omens, and mix up their religion with their farming operations in a way which proves fatal to the latter. These "traditions of an immemorial religion of agriculture" will prove a great practical difficulty against which agricultural reform will have to contend. But in improved agriculture lies the safety valve of Indian financial troubles. There is hardly any branch of industry which is not capable of being largely developed by encouragement and intelligent direction. Cotton, jute, indigo, &c. [illegible] iron, and coal—[illegible]

enough to enable him to refresh and invigorate his land by manuring and rotation cropping; but this, unfortunately, he cannot do in nine cases out of ten; he must live, he must pay his rent; and so he struggles on, making his land pay as long as he can under his rough method of surface cultivation, until he can hold out no longer, his fields being to all intents and purposes racked—for the time, at all events—he overwhelmed with debt, and totally unable to extricate himself from the usurer's hands. The ryots have a keen eye to the results of a good system of farming as exhibited on model farms, but they cannot derive much good from the knowledge, though they may take it in and thoroughly understand that superior tillage and proper manuring mean a greater outturn in crops. Their great want is *capital*, and a want which, in the impecunious state of Indian financial affairs, is hardly likely to be relieved. The ryot in his present condition cannot afford to buy firewood for fuel; he burns, therefore, the manure he should use to enrich his land; his agricultural implements, ploughs in particular, are too primitive to ensure deep ploughing, his cattle too feeble to work the better kind of plough, even could he afford to purchase it; a superior class of cattle and superior farm implements mean to him so much outlay of what he has not—money.

If European farmers take up Indian land, with capital to back them up, then indirectly will the poor native cultivator be benefited, then he may be rescued from the hands of the village moneylenders; but until this is done, no system of real agricultural reform can take place, because the ryots are ground down by debt, and cannot afford to farm even up to the knowledge they have. The improvement of the present condition of the ryot is the very first step; and the main point towards this desirable end would be, as Mr. Hume

points out, "to remove all cases connected with the money and grain transactions of the agriculturists as such, from the cognizance of the regular courts (endless litigation being a fruitful source of trouble, discontent, and poverty amongst the rural population), and secure the adjustment of all these by local tribunals." The money now spent on agricultural usury is said to be *threefold that employed in trade*, which accounts for much of the poverty of the poorer cultivators. It is suggested that Government might by degrees undertake the advances required by the ryots, which they now raise under the disastrous village usurer's loan system, which, far from really helping them, only sinks them deeper and deeper in the mire of debt each year. In the case of European planters of indigo, sugar-cane, and so on, the advance system has been found, when fairly conducted, productive of the greatest good to the small cultivators cropping land under it; on a larger scale Government might employ the same method of advances; the periods over which these advances extended would lessen each year [illegible] short time be required [illegible] the ryots would be freed from [illegible] of interest they are now [illegible] lenders, and in time [illegible] tion, and able to [illegible] view to the continuing [illegible] exhausting the [illegible] less continual [illegible]

Model farms [illegible] Bhadgaon, Bangalore [illegible] produced from Indian [illegible] conditions; [illegible] is capable of [illegible] Agricultural [illegible] years before a system of high farming [illegible]

introduced into India; indeed, if it did prevail the results would probably be open to question. To improve the class now sunk in such poverty and distress, a broader method of teaching would be necessary. They must be taught to realize more thoroughly the commercial value of their stable products than they now do. Wheat and rice are the cereals which will pay the ryot best to cultivate. The first, might be produced in much greater quantities than it now is (see "WHEAT") and the second might be planted under a different system, at less cost of time and labour: this could be done by introducing Carolina rice more generally into the rice-bearing districts. Then, again, with cotton, American cotton might be distributed, to the improvement of the staple of Indian cotton, in which particular it is found wanting, and better methods of cleaning it might with great advantage to the trade be established: better ploughs might be introduced, and the natives taught their use; better harrows also. The Indian plough (see "RICE") is of no use for deep ploughing, and necessitates much labour, as the ground has to be ploughed over half-a-dozen times, where one or at the most two ploughings with a superior implement would secure a larger result. Better seed might be introduced, and greater care in separating seeds might with advantage be inculcated; here the Indian cultivator is undoubtedly careless, and by sowing different sorts of grain together, to ensure getting a crop of one or the other, spoils the grain for the market, and lowers its price. Greater cleanliness in harvesting is another essential point, and one in which, owing to the absence of proper machinery, the native cultivator is found sadly wanting. In all these particulars much might be done by an Agricultural Department, with intelligent men scattered throughout the different provinces overlooking, suggesting, and with money at command, advanc-

ing, under some regular and properly organized system, certain sums to deserving ryots to ensure their being able to crop their lands at proper seasons. If the sole aim of such a department was the general improvement of the agricultural condition of the country, and the thin end of the wedge was judiciously inserted at starting, the result could not fail in the end to be most beneficial to the whole empire. The extended system of advances alone would do much towards the moral improvement of the native; for the present system of indebtedness ending in extensive and wearisome litigation cannot fail to demoralise him. An advance to ryots at the proper periods would enable them to produce more valuable crops than they now do and in larger quantities, allowing them also to cultivate their ordinary crops on a more liberal scale. By degrees the condition of these ryots would be raised, their frugal habits would cause them to accumulate some small amount of capital; and it is just this capital which is needed if any real improvement in India's agricultural condition is to take place. Now the poor ryots have more land than they can really do justice to in many instances, or properly manage; it was, I think, Mr. R. N. Elliot's suggestion that when such was found to be the case, the ryot should be required to allow some portion of his land to lie fallow for a year or more, or cultivate only with grass or fodder for the purpose of manure, or for the use of cattle, the lands so lying fallow to be exempted from assessment, or assessed lightly. Colonel [illegible] suggestion (see "RYOT") is also a good one. It is very evident that the fertility of Indian soil has decreased of late, that the yield of produce per acre is smaller than it used to be, and that the soil is really from some cause or other, exhaustive cropping, or continued drought and greater dryness of the climate, deteriorating yearly; such being

the case, no time should be lost in setting about the work of general improvement. It will cost money, but a judicious outlay now may, and probably will, mean a safeguard from future bankruptcy of soil. Alarmists say that the soil is now in this state; but judging from its present power of productiveness, though considerably less than in years gone by, there is yet time to arrest the evil: one of the first steps being to raise the agriculturist into a better position; when he is lifted out of the dire state of poverty into which he has sunk, he will improve his land, always provided he is assisted when it is necessary by advances. If Government took up this question one of the first effects it would have would be to reduce the rate of interest charged by the village money-lenders and bring them down to a reasonable rate of interest on loans, finally rendering the ryot free from their snares altogether. Moreover, the Government would be brought into much closer contact with the native agriculturists, and loyal feelings would spring up, where now discontent reigns supreme.

Indian agriculture is so intimately connected with Indian industries that I have dwelt at length on the subject. India's vast natural resources can only be advanced and more freely developed by proper attention being paid to her agricultural interests; these, unfortunately, it has been too much the fashion in past years to neglect, and so indirectly and directly many of her most paying sources of revenue have suffered. With regard to vegetable products, the want of a proper system of cultivation and the absence of proper appliances too often dwarf and cripple the most apparently prosperous undertakings. These wants and failings would under a responsible Director-General of Agriculture be relieved and remedied. Let us hope this scheme will not melt away, as too many have done before it; but

CHAPTER II.

BEER.

FORMERLY all the beer used by our troops in
was imported from England at an immense cost
attended with considerable loss in many ways; but
this important branch of European industrial ente
is yearly increasing in India. The Governme
India has within the last few years turned its atte
towards the Hill breweries; and it is to be hop
years go on support and encouragement will be
fully bestowed on Indian brewers than has hit
been the case.

The brewing of Hill-beer is a question sensibly a
ing the Indian revenue, for naturally it can be br
in the country at far less expense than it can b
ported from elsewhere. Beer for the British s
plays no mean part in military expenditure, at ho
abroad. It has been roughly stated that in the B
Presidency alone the annual consumption of beer b
troops is about 50,000 hogsheads. The saving o
amount, if Hill-beer at ten rupees per hogshead
substituted for imported beer at 65 rupees per
head, would amount to five lakhs of rupees. The
too, by ullage and condemnation on the imported
which is said to amount to more than three lak
rupees, as each year between 5,000 and 6,000 hogs
are lost value 65 rupees per hogshead, would be s

Some years the losses by these means are very . . . for example, in 1875, when the quantity of beer des. . . in Calcutta as unfit for use was estimated at bet. . . 25,000 and 30,000 hogsheads.

Hill-beer is unquestionably a wholesome beve . . . our soldiers' use, especially now that the beer . . . of good quality. At first it was decidedly in . . . the imported beer; but improvements w. . . effected; the soldiers like it, because it is, tho . . . strong, far purer and more free from adult. . . besides being often more palatable than the beer . . . has come off a long sea voyage, to say nothing of . . . journey during which it has not only been exp . . . great heat, but has more or less become soure. . . With English contracts the charge for freightage . . . destined port of disembarkation is generally con . . . but not the inland charges from the port to the st . . . for which the cargo is booked; and land carriage is, as all know who have been much in India, very heavy. Moreover, Government has to bear all risks or casualties which may occur to the shipment, to say nothing of the loss by exchange, and the other losses by ullage and condemnation before alluded to. It stands, therefore, to reason, that beer brewed in India can be purchased from the Indian brewers by Government far more economically than it can be supplied from England or elsewhere. It can be brought down into the plain stations from the hills in either large or small quantities, and but little loss is incurred *in transitu*, the journey being a comparatively short one, and the risks of deterioration in quality but slight; whereas English beer has the sea voyage, the storage for some time on arrival, and the final land journey of many hundred miles to its destination in the Upper Provinces. Small wonder that when it does arrive it is condemned as unfit for issue to our troops.

I know myself from experience how difficult a matter it is to keep imported beer in a drinkable state; in the hot weather almost an impossibility, and also how very expensive it is to procure, the charge on transit being so unproportionably heavy. An 18-gallon cask of ale on delivery in Mooltan would cost three times what it would in England. The beer obtained from the regimental canteen is often quite unfit for human consumption; the wonder being that the British soldier, though he may and does grumble, yet contrives to drink it, even in the very hot weather, without being seriously inconvenienced by it.

Hill-beer, on the contrary, though it may lack body, is, generally speaking, sound and fit to drink; for the very want of strength complained of makes it a much more wholesome beverage for the hot season.

Yet with all that can be said for Hill-beer on the score of its cheapness and its wholesomeness, this newly established industry does not meet with that amount of encouragement from the Indian Government which it might naturally expect. Why it is not easy to say. One objection to the Indian brewer is that his profits are said to be so enormous. These profits must be vastly exaggerated. The Murree Company, which is the most flourishing of all Hill brewers, has never returned a larger dividend than 18 per cent., and many English breweries could without doubt show larger profits than that. The other Indian breweries, of which there are not more than ten or twelve, do anything but a thriving business, some of them hardly even paying their way. In the face of the short two year contracts by which the Indian brewer is tied down, it would be impossible for him to make those ruinous profits which it is alleged he does. The brewer must look ahead and make preparations for the future; and if only such a short contract is allowed him, how can he do this?

Neither can he command the sale for his beer which an English brewer can; the latter has a beer-loving general public to support him, the former has only the commissariat, for the native population are not beer-drinkers.

The English brewer considers himself ill-used because India is commencing in the matter of beer to supply her own wants, and each year to show more decidedly her independence of England; but surely if India can save herself so many lakhs of rupees annually by her increasing industry, she should be encouraged to do so. English trade jealousy is the bane of Indian advancement, and the more we look into the subject the more strongly shall we see this.

With the present outcry as the head of Indian financial economy, and the necessity for cutting down expenditure in all branches, the folly of continuing to import at vast expense what can be procured in the country far more reasonably may possibly appear to the Indian Government in a new light, which may cause them to pursue a more liberal course [illegible] the matter [illegible] was made [illegible] manufactured [illegible]

That there is an [illegible] for ordinary drinking [illegible] are well aware [illegible] beer, and [illegible] 1878 they had taken [illegible] ing the home [illegible] value of which [illegible] $11\frac{1}{4}$ lakhs. [illegible] brewers [illegible] place. But [illegible] demand for Indian [illegible] it will in India [illegible] and here India [illegible]

have not hitherto flourished. In Kashmir the Maharajah started a plantation of 100 acres, at first with more than average success; but the severe droughts to which the Indian climate is subject are fatal to hop-cultivation, and killed off the hop-plantation in Kashmir. If therefore the demand for Indian Hill-beer steadily increases, the supply of hops must fall short. And here will be an opening for our Kentish, Sussex, Herefordshire and Hampshire farmers. Already our imports of hops to India, that is up to the year 1878, when there was a decided decline, have been increasing; but if there continues to be a request for hops in India, English hop-farmers may count on a fresh and yearly increasing market, and with the decline of our beer exports to India should commence the decided increase of our hop exports.

Borax (see "Chemicals").

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cocoa made into a paste and flavoured is called chocolate.

The nuts are exported in bags of about 112 lbs. each, and are quoted in the Mincing-lane Price Lists at so much per cwt., the price now being from 91s. to 106s. for Trinidad, the best imported. When in this state the nuts are rather like almond kernels, with both ends blunt, and about twice the size. The consumption of cocoa has much increased since 1864, when only 3,862,273 lbs. were consumed; in 1878 the quantities had risen to 10,000,000 lbs.

In cultivating the cacao tree the young plants have to be shaded and well supplied with water; they are raised from seed, and come into bearing when about six years old. A tree is said to yield when at maturity 150lbs. of seed annually. Plants of cacao are offered for sale now at the Peiedynia gardens at one rupee per dozen. Since its first introduction the cultivation of the plant has greatly spread in India; the Trinidad variety is the most sought after, it is the most hardy and yields the largest crop. In Jamaica cacao growing has died out very much, though efforts are being now made to restore it The yield of Jamaica trees was at one time very large, but now Trinidad cacao bears off the palm. The Indian climate appears in every way to suit this plant; its cultivation is rapidly increasing, and its value becoming more thoroughly recognized each year.

CHAPTER [illegible].

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All Eastern styles of ornament, varied as they are, will be usually found to rest on a sound basis; and those who superintend the making of these carpets will do well to allow no novelties, in the form of Western designs, to creep in. By teaching the weavers to look backwards to the art antiquities, and the decorative styles of ancient and mediæval Eastern workmanship, this old art will be kept up and invigorated: but to do this, all introduction of the more brilliant colouring and too generally defective designing of modern styles must be jealously guarded against; or glaring colours and questionable patterns will assuredly creep in, and vitiate the really sound taste exhibited by the natives if left to themselves. Unfortunately as it is, the art is declining in India, that is amongst the people themselves, and the gaols furnish the greater portion of the commoner styles of carpeting.

The true Indian carpet is now rarely met with, though the imitations of it are numerous enough. The Oriental carpet, subdued in colour and its tints perfectly blended, finds less favour in a dull murky climate than it does in the glaring sunlit East, where its faded softened hues are a rest to the eyes, tired with the prevailing strong light; but English customers want more colour, that is brighter, harsher, less modulated colour; and the endeavour to introduce such high colouring into Oriental carpets in accordance with the taste of Western, and by no means artistic or æsthetic customers, cannot fail to do harm to the Oriental carpet weaver's designs, and thoroughly disturb his theory of harmonious colouring.

The *Pioneer*, writing on this subject, gives the following example of a case recently brought under its notice:—" A regiment, ordering some carpets at a well-known gaol to take to England for its mess, sent some officers to see what patterns were to be procured; and the

[illegible] every [illegible] p[illegible] wh[illegible] and [illegible] of [illegible] and [illegible] colo[illegible] and [illegible] wrong [illegible] than [illegible] every [illegible] would [illegible] made [illegible] trade."

It is [illegible] for [illegible]

instead of being allowed to die out, or else so intermingled with so-called modern *improvements* as to be undistinguishable. The taste in England for Indian rugs and carpets appears to have increased within the last two years, since the rage for æsthetics has set in, and rooms furnished according to Eastern taste, with Scinde and Persian rugs, oriental stuffs for hangings and so on, have become the fashion. This, as those who lay claim to æsthetic tastes rarely depend on their own individual taste, but like sheep follow each other, and are all dependent on some leader of fashion, who really has artistic feeling, and a sense of the fitness of things, may do good in reviving the taste for the purely Oriental in design, and give an impetus to the Indian carpet industry, which is in a decidedly languishing state.

esteemed and fetches a high price; owing to this it is eaten chiefly by the opulent natives, not by the poorer classes, who sell it when found instead of using it for food. In Bengal, if there has been any rain, and the ground is tolerably moist, the ryot begins to plough his rice land about the middle of February, ploughing again more carefully in March and April; the land is always ploughed three times before sowing. A Bengal plough consists merely of a crooked piece of wood, sharpened at one end and covered with an iron plate, which forms the ploughshare; to the other end is fixed a wooden handle crosswise, which is about two feet long and has a long piece of straight wood or bamboo in the middle, called *isha*; this divides the bullocks and falls on the yoke, to which it hangs by means of a peg and is roughly tied with cord. Having sown in May, the ground—if rain has fallen—being previously well and thoroughly weeded, the *hengha* (harrow) is passed over it. The field has then to be carefully watched lest the birds come and scratch up the freshly-sown grain. When the rice is up and has reached about six inches in height, a wooden instrument with rough spikes is drawn over it to prevent its growing too fast and becoming rank. When it has grown to a foot in height, it is carefully weeded and cleaned. Rice is generally fit for the harvest about four months after it has been sown, that is in August, when it is reaped with a sort of reaping hook not unlike our sickle, called a *hussom*, and having a jagged edge. After reaping the rice is collected in bundles, and carried at once off the field by women, girls, and lads, on their heads to the threshing-floors. Here the bundles are stacked for some days until the ryots are ready to thresh them out. The ground on which rice is grown is usually of too swampy a nature to allow of ordinary cartage. So the labour in gathering in the rice harvest is very great; it is to natives a very

off by hundreds. Ricardo says: "In those countries where the labouring classes have the fewest wants, and are contented with the cheapest food, the people are exposed to the greatest vicissitudes and miseries. They have no refuge from the calamity: they cannot seek refuge in a lower station: they are already so low that they can fall no lower. On any deficiency of the chief article of their subsistence, there are few substitutes of which they can avail themselves, and dearth to them is attended with all the evils of famine." This is entirely true of the Indian native: when the price of his ordinary food advances beyond the usual rate, he is sunk into utter wretchedness; he has no reserved funds to draw on for assistance; and his wages if a labourer—or *coolie* as we should call him in India—instead of being increased in times of dearth are, *au contraire*, decreased; and, moreover, the competition for employment is increased, while the means of paying for field-labour are diminished.

In April the ryot sows another plot of ground besides the one which will be ready to reap in August. The rice sown in this is intended for transplanting in July, when the rains have set in, to another field ploughed up in preparation for it. The rice is taken from the nursery and replanted in the new ground in tufts of two or three plants: the growth of these rice-tufts is very rapid, as the land stands in water for three months more or less. In cases of flood, the rice actually grows with the rise of the water, keeping its tips just above it unless the rise is too sudden, in which case the crop is destroyed, for rice cannot stand being wholly submerged for any length of time. If the season should be unfortunately a dry one, then the rice-farmer irrigates his fields. This crop is reaped in October or November, sometimes not till December. Where the land is very good a third crop is sown on the ground from which the August harvest was reaped; but this is chiefly done to

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very favourable and its suitability for rice-culture: the rivers are numerous, and so an abundance of water, that *sine quâ non* with rice-growers, is assured, while the extreme native richness of the soil gives every hope that with careful culture the rice industry in that district must rapidly increase.

Rice in the husk is, as I have before stated, called "*paddy*;" the practice of importing it in this uncleaned or unshelled state at one time gained ground; within the last five years it has decreased again, and now almost all the paddy exported from India is consumed in Ceylon, the trade with which, setting aside the duty levied on the exports thither, may be considered as practically merely a coasting trade. The reasons at one time urged in favour of paddy importation by us were, that its cost was lower in the foreign markets, and the importers of it avoided a large proportion of the customs duty charged on the prepared grain: moreover, the loss by weight during transport was less than that suffered by the shelled or cleaned rice, while with good and effective machinery the rice in the husk could be well cleaned *after* its importation into the United Kingdom.

Now, the real trade is in cleaned rice and "cargo rice," the two figuring in the returns under the head of "rice not in the husk." "Cargo rice" consists of about one part in five of paddy; the Burmese exports of rice consist chiefly of this mixed sort, which is called in that country "five-parts cargo rice." This is used chiefly for distillation, or for conversion into *starch.* It is not an agreeable-looking grain, being thick and coarse, and when boiled looks even less inviting; neither is its flavour as good as that of the better qualities of Bengal rice. The Patna rice is esteemed the highest of the Eastern sorts imported into Europe; it is finer in the grain than the Bengal rice, though the "table" rice

oming from the [illegible]
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ies can bear comparison with [illegible]
nquestionably the best which [illegible]
or culinary purposes; [illegible]
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ot for the poor; the [illegible]
mostly Chinese, [illegible]
he inferior Indian and [illegible]

In Europe, where nearly [illegible]
xported close on [illegible]
sed principally for these three purposes [illegible]

1.—[illegible]

2.—[illegible]

3.—[illegible]

The following table will [illegible]
not in the husk) during [illegible]

Year.	[illegible]	[illegible]
1872–3	[illegible]	[illegible]
1873–4	[illegible]	[illegible]
1874–5	[illegible]	[illegible]
1875–6	[illegible]	[illegible]
1876–7	[illegible]	[illegible]
1877–8	[illegible]	[illegible]

The average of the last [illegible]
million tons a year. [illegible]
J. E. O'Conor's [illegible]
1879, the trade in [illegible]
ast five years it has [illegible]

... export, is on an
... tons annually;
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... in India that the
... would materially
... apprehensions proved to be
... the trade from
... amply prove.

... than either
... fields, notably those
... supply France with large
... for re-exportation to
... and America. Japan also
... England, Continent
... European consumption of
... speaking met by the Indian
... the Indian: it amounts or
... Then a great deal
... in the various colonies, Chinese
... consumption being at the rate
... the residue, some 280,000 or
... to India's nearer neighbours
... and so on.

... the largest percentage of starch;
... in rice is as much as 86
... grain is said to yield 80 per
... use a sort of rice-glue in dressing
... cotton threads for weaving. This
... is made by mixing rice-flour with
... then boiling it; very often calico is
... preparation, only of a thinner sort,
... by dishonest sellers, as it gives a
... to the linen, which of course makes it
... and finer texture than it really is; the
... made from this doctored mater
deception is easily found out; a h

The share of Burmah in this total export, is on an average 12,214,512 cwt., or 612,075 tons annually; at least, that has been the average of the last three official years. At one time fears arose in India that the Saigon and Bangkok trades in rice would materially affect her exports; but these apprehensions proved to be without foundation, as the returns of the trade from both places for the years 1875-6-7 amply prove.

Italy is a competitor more to be dreaded than either of those named; because her rice fields, notably those of Lombardy and Piedmont, supply France with large quantities of the article, mostly for re-exportation to the French colonies in Africa and America. Japan also exports rice of a very good quality to England, Continental Europe, and America. The European consumption of rice is, however, really speaking met by the Indian exports, supplemented by the Italian; it amounts on the average to about 580,000 tons. Then a great deal is consumed by coolies in the various colonies, Chinese, Indian natives, etc., their consumption being at the rate of 120,000 tons annually—the residue, some 280,000 or 290,000, being exported to India's nearer neighbours Ceylon, Arabia, Persia, and so on.

Patna rice contains the largest percentage of starch; the amount of starch contained in rice is as much as 86 per cent., and the Patna grain is said to yield 80 per cent. The natives use a sort of rice-glue in dressing and preparing their cotton threads for weaving. This they call *conjee*; it is made by mixing rice-flour with cold water, and then boiling it; very often calico is dressed with this preparation, only of a thinner sort, when ready for sale by dishonest sellers, as it gives a beautiful gloss to the linen, which of course makes it look of a better and finer texture than it really is; the first time the articles made from this doctored material are washed the deception is easily found out; a hard

rubbing between the hands when purchasing e often cause the presence of this dressing to be seen as a white powder is raised by the friction.

A very large proportion of the rice imported United Kingdom is used in distillation, and the liquor in the conversion of which it has l finds its way to India: in the cheap gin an which enters that country, is very much of originally exported from it, besides the size goods which are quite as much dressed up by Manchester for the Indian market, as by the themselves for their home markets. Rec attempt has been made to induce the Indian ment to take off the export duty on rice. If done the ryot would be encouraged to grow mo than he does at present. The duty is now very lessened to what it was formerly, being at the r 3 annas per maund of 3,200 tolas; while even a small duty continues the ryots reap but little benefit from increased growth for exportation; because though the greater the quantity raised the cheaper the price, yet the heavier does the tax fall not only on the exporters, but also indirectly on the original growers of the article.

It is on the other side urged that in lowering the duty very much, or taking it wholly off, the trade would be too much stimulated, and the food of the people sent away from the country in too great quantities, and there is undoubtedly a great show of reason in so regarding the question; but, on the other hand, the country would be a gainer in the increasing of this branch of Indian commerce; besides which, if the ryots were encouraged to cultivate more rice land, there would be sufficient both for home consumption and exportation also.

WHEAT.

It is only within the last ten or twelve years that India has been really reckoned among wheat-producing countries, or that the grain from her shores has found a market in England. But each year since the one which saw the first exportation of Indian wheat has been one of increase, and various causes have combined to occasion this augmentation. The Turkish war, by cutting off our importations from other countries, opened up a way for India still further facilitated by the Suez Canal, without which line of communication little indeed could have been done in the trade. Then the abolition of the Indian export duty on wheat added considerably to the quantities exported; and during the season of famine the ryots parted with their stores of grain, the more readily as they became more impoverished. How far such a stimulant to the wheat trade can be considered a healthy one is an open question; and it may be naturally asked why when India in 1876 and 1877 was suffering so severely from famine should so much grain have been allowed to be exported? For the quantity of wheat then parted with was certainly not because it could really be spared without its loss being felt, but because the ryots were obliged to raise money to pay their taxes and their rents; and instead of being able to do so with their usual crops, which had more or less failed, they had to have recourse to their grain-stores to raise the hard cash needed to pay their way. In 1877 when the exports (see table) reached their highest, India was in the greatest straits; and that state alone accounts for the vast increase apparent in her wheat exports.

That she might contribute a certain quota to the quantity of wheat required by the United Kingdom is an entirely different question; but this must be done

by India's having a greater acreage under wheat she has at present. Now this cereal is chiefly grown Northern and Central India. In the Southern por our vast Empire, wheat is very little grown, and crops of it are harvested are of very inferior qu One of the greatest faults in the Indian wheat exn is not in the quality of the grain itself, which excellent in many cases, but in the manner in is reaped and threshed. The wheat is exporte dirty state, which indeed can hardly help being the case, while the old primitive methods of preparing it for exportation continue. This dirty state of the grain, which is so generally complained of, arises from various impurities finding their way into the wheat while it is being threshed out. The usual method of threshing is by cattle tied together, who walk round and round on the corn, which is spread in a ring. This is at best, and when the greatest care is taken, a most unsatisfactory process. Half of the grain is wasted, and what is gathered in is so mixed with dirt, small stones, and so soiled by the cattle treading it out, that the imperfect method of winnowing which follows the threshing, entirely fails to free the grain from the filth with which it has become mixed.

Many suggestions have been made that English threshing machinery should be introduced, and also winnowing and screening machines. This is, however, not practicable; possibly in large towns such machinery might be of advantage, that is along the line of rail; but in the central districts, and more secluded villages, the badness of the roads would prove to machinery travelling from place to place an almost insurmountable obstacle, and the cost of transit must raise the price at which the machines could be hired far beyond the poor ryots' slender means, and would prevent them from being of any service to this particular class. If

machines such as those in use in Australia could be introduced into India, they might possibly do some good. I allude to "Ridley's reaping machine," which cuts off the ears of corn, and extracts from them the grain while it is passing along. The Australian wheat which comes into the market is, though really not at all finer in quality than the Indian wheat, *clean*, and therefore it fetches a better price, and is in more demand.

Another reason why Indian wheat is less thought of is, because it is so mixed with other grain; the Indian, knowing well the loss he incurs if a crop fails, is in the habit of "hedging," if I may so call it, by sowing two or even three crops together; so that if one fails, another may prove a success, and he may not be a loser in the long run. However desirable this system of agriculture may seem to Indian cultivators, it is much against the value of the exports. If wheat, barley and pulse are all sown together, it is next to impossible thoroughly to separate the grains, as the crops are of course reaped and threshed together. Mr. A. O. Hume, C.B., in his admirable pamphlet on "Agricultural Reform in India," alludes to this almost universal practice when he says, "Greater cleanliness in harvesting and greater care in separating grains and seeds intended for or likely to reach foreign markets, would probably do much to improve the demand for our agricultural products. Could we only secure a fairly steady and moderately large export trade in wheat and barley, for instance, there is no doubt that in a very few years the better prices given by purchasing agents of exporting firms would effect a complete change in the existing slovenly practices; but, unfortunately, it would seem that, at any rate until the more easily accessible virgin lands of Western America are more or less exhausted (and they do appear to be exhausting these in a wickedly wasteful manner), it will only be under

India; and when wheat rises in price, as it would seem it must do ere long, Indian produce will without doubt be shipped in larger quantities; the cost of transit from India to England is the most serious consideration; and from the central districts, where wheat is chiefly grown, it cannot be conveyed to the ports of exportation, Calcutta and Bombay being the principal, under 20s. per quarter, and the charge from either port to England for freightage would not be much under 31s. per ton. Dr. Forbes Watson, in his very interesting report on Indian wheat, estimated the total production of the wheat-growing districts of India at about 40 millions of quarters, reckoned the average yield to be about 13 bushels to the acre, but in some districts the yield is much less, from 8½ to 9 bushels only per acre, much of course depending on soil and other advantages. On clean friable land, with a good supply of water, the crops might be made to yield much more by the application of nitrate of soda or even with a larger supply of ordinary manures; proper and sufficient manure is, however, one of the chief wants of the Indian agriculturist, to which time alone will open his eyes.

The classes into which Dr. Forbes Watson separated the samples of wheat submitted to him for examination —about 1,000 different samples being sent—were four: —1, soft white; 2, hard white; 3, soft red; 4, hard red, these being in order of merit. Most of the samples were of superior quality, 101 being described by him as *very* superior. It will be seen, therefore, that as far as quality is concerned, India need not fear the competition of other countries, provided she makes great improvements and advances in her methods of preparing the grain for exportation. The same authority before quoted states that "India is one of the largest wheat-producing countries in the world." The United Kingdom produces, say, from 10,000,000 to 13,000,000 quar-

ters yearly; Russia, 35,000,000 quarters; Germany, from 15,000,000 quarters to 18,000,000; America, 45,000,000 quarters; India, 35,000,000 quarters. France producing enough—barely so—for her own consumption, could not enter into exporting competition with India; the probability being that, like England, she too, will have to import to supply her own deficiencies. America then, according to Dr. Watson, is the only country to which India ranks second, her wheat-producing powers being equal to Russia and France, and far beyond Germany.

But, unfortunately, the wheat shipped from India is in no way equal to the samples quoted at 47s. to 48s. per quarter; indeed, the shipments fetch from 8s. to 10s. less than good foreign wheat, American or Australian. The reasons of this have been stated; that in best demand in England is the "soft white," known in India as *safed*, *muria*, *dandi*, &c. Wheat in India in August of last year was selling at Rs. 13-8 per quarter—or 27s.; but if shipped at that rate to England viâ the Cape it would have mounted up to from 40s. to 42s., that is, considering the rate of exchange at 1s. 8d. the rupee. The price for Indian wheat, the best samples, averages only 39s. to 40s. per quarter. So exportation by that route would not have paid; but the charges viâ Kurrachee are considerably lower, being reduced nearly 8s. per quarter. Dr. Watson points this out in his report; and as the Punjab will in all probability be the chief wheat-exporting district in India, the facilities for transit to Kurrachee, and freight by sea from that port, will improve the prospects of the Indian wheat trade considerably. The following are the exportations of wheat from India, extending over the last five years:—

Year.	Cwts.	Rupees.
1873–74	1,755,954	82,76,064
1874–75	1,069,076	49,04,352
1875–76	2,498,185	90,10,255
1876–77	5,583,336	1,95,63,325
1877–78	6,340,150	2,85.69,899

During the year 1879, the trade has fallen off very considerably; other countries besides India competed with her in supplying the deficiencies of the United Kingdom, and prices fell, which made the Indian shipments unprofitable to exporters, while at the same time the drought and partial failure of the crops in the Punjab, the North-Western Provinces, and Oude, raised the grain prices in India to a higher level than the English prices. This practically put a stop to the trade during the current year. For 11 months of 1878-9, April to February inclusive, the export was only 1,040,517 cwts., which collapse was owing to the reasons stated above. It is, however, naturally to be concluded, that if so much wheat were grown for export the preceding year when the figures reached were 6,340,150 cwts., that a very large area must have been under wheat cultivation this official year also; and though the drought and partial failure of crops in the districts mentioned affected doubtless the amount of grain really harvested very considerably, still there must be in India a much larger quantity of food (grain) than in 1877-8, when so much was sent out of the country; and therefore in this particular the Indian population is in a measure better off this year than it has been for sometime.

BARLEY *(Hordeum distichon)*

Is cultivated in the Himalayas, up to an elevation of 15,000 feet. Several different varieties are grown,

besides this it is not beaten down by rain, and really speaking the only enemies the grower of maize has to dread are birds when it has reached its full growth, and insects in the early stages of its cultivation. As a food it is palatable in many ways; we used it green as a vegetable, cooked the same day it was gathered, stripping off the husks and boiling, the corn being plunged into water at boiling point. When ripe it is simply roasted, and served very hot with butter.

Maize is chiefly cultivated in Upper India and Behar; in Bengal it is not so much grown, rice being more used by the natives; but in Behar it forms with the *jowar*, *janeera*, and *shamah* the staple food of the greater portion of the population.

The land on which maize is cultivated is generally ploughed up about May; in poor soils a top dressing of manure is given; a second ploughing takes place about a week after the first, and directly the rainy season commences the sowing begins. The seed is sown in rows from three to four feet apart, to allow of ploughing when the plant has reached a certain height; if, however, ploughing is not resorted to, the distance the rows are set apart is only from two to three feet. When the young corn has appeared the cultivation begins, and once a week for four or five weeks the spaces between the rows of plants are well stirred up; after this operation the growth of the corn is very rapid, and in August the stalks have reached their full height and the ears are well formed. When the grains begin to harden the leaves and tops of the plant are removed, and are tied up in bundles for fodder for cattle. The grain, when hard and ripe, is gathered, well dried, and put away, in the husk, in an airy place to dry. Two crops can be raised in one year off the same land; but in that case the first sowings take place as early as March; two crops are not often raised, as irrigation would be necessary for the

[illegible]

JOWAREE (*Sorghum vulgare*)

Is a grain universally cultivated. It grows on most soils, but thrives best in black soil. There are several varieties; those chiefly sown are a species with red seeds and one with white. This plant is also much esteemed for fodder; it is most prolific, a single plant sometimes producing from 8,000 to 10,000 seeds. It is grown in Nagpur, Madras, Baroda, Sattara, Surat, Ahmednuggar, Nassick, Belgaum, Kutch, Sind, Berar, Indore, Oude, as well as in many other places, and is a grain highly valued by the natives of India both as food for themselves and fodder for their cattle.

GRAM.

There are various sorts of gram, or at least grains that bear the name of gram, in India.

The *Dolichos uniflorus* (Linn.), or horse-gram plant, which has grey seeds—there being also a black-seeded variety of the same plant, is used all over India for feeding cattle, and for horses, both sorts of seed being excellent food, varied with urdawa and bran by way of a change; working bullocks do well on this food, though they are more usually fed on an inferior kind of gram, cotton pods, and seeds. This gram is generally sown at the end of the rainy season, and in good soils yields as much as fifty or sixty fold.

Cicer arietinum (Linn.), or Bengal gram, the common chick-pea, is also largely used for cattle, and the seeds are eaten by the natives as well as mixed by them in their curries.

Phaseolum mungo (Linn.), or green-gram, is more cultivated by natives than the other two sorts mentioned; they value this pulse very highly, especially in times of famine and scarcity. Considerable quantities

f it are exported annually from [illegible] to [illegible], Bengal, the Mauritius, and Pegu. [illegible] variety having dark seeds, [illegible] gram. Green-gram is usually [illegible], and reaped in the hot, taking from [illegible] days to arrive at perfection, [illegible].

P. Roxburghii is also found in [illegible], bearing green, the other black seed. [illegible] very extensively grown by the natives, and used by them as food for themselves and [illegible] cattle.

The seeds of the *P.* [illegible] natives, they cultivate it for its seeds; [illegible] good fodder for cattle.

The *Cajanus Indicus*, or pigeon pea, [illegible] valued by the Hindoos; they [illegible] leguminous seeds, and eat them [illegible] compound being known as [illegible]. [illegible] arvense, the common pea, is [illegible] India.

[illegible]

Is about the most [illegible] and forms the [illegible] in India. [illegible] tility, save that [illegible] 81,000 [illegible]. In [illegible] it is also [illegible] of the [illegible] keeps [illegible].

Amongst other [illegible] may mention the following:—

Bagra, or [illegible] millet, [illegible]
Italian millet, [illegible]
Hairy millet, [illegible]

Indian millet (*Panicum miliacum*).
Little millet (*Panicum miliare*).
Barti (*Panicum brizoides*).
Wild rice millet (*Oplismenus colonus*).
Sawa millet (*Oplismenus frumentaceus*).
Koda millet (*Paspalam scrobiculatum*).
Bamboo grain (*Bambusa arundinacea*).
Buck wheat (*Fagopyrum esculentum*).
Rajgeera (*Amarantus frumentaceus*).
Lentil (*Ervum lens*).
Chowlie (*Dolichos sinensis*).
Barbutti (*Dolichos catjang*).
Gowar (*Cyamopsis psoralioides*).
Mutt (*Phaseolus aconitifolius*).
Sword bean (*Canavalia gladiata*).
Nankin bean (*Lablab vulgare*).
Soy bean (*Soja hispida*).
Horse bean (*Faba vulgaris*).
Kidney bean (*Phaseolus vulgaris*).

Some of the bean varieties are not so much cultivated in India as they might be; for though too rich for employment as food alone, mixed with other substances they are most nutritious, and would prove invaluable to the poorer natives. The common horse bean, seen so constantly in England, is very sparingly grown in India; in the North-Western Provinces it has been cultivated, but the ryots do not appear to value it as much as do farmers of other countries.

CHAPTER VI.

CHEMICALS.

SALTPETRE.

SALTPETRE, or nitrate of potash, [illegible] a natural and as an artificial production. [illegible] the surface of the soil [illegible] Egypt, Italy, and other countries. [illegible] nown in commerce [illegible] —the lixiviation of certain soils. [illegible] orted from the East Indies [illegible]

Year.	Cwts	£
1874	451,197	464,974
1875	553,330	501,468
1876	415,080	348,949
1877	466,218	381,706
1878	389,002	379,002

Chemicals have, since Lord Beaconsfield's allusion to them, been a good deal talked about. To those not conversant with the importance of this industry, this reason for selecting their increased activity as a proof that trade was reviving, was a matter for question; but the trade in chemicals is mixed up more or less with every manufacturing industry, and therefore its activity or depression is a very fair test of the general state of all our most important manufactures. It may appear a rather obscure branch of commerce to very many who have never given any attention to it; but it is of immense magnitude in reality, and that a little investigation will soon show. Liebig's famous dictum, uttered many years ago, "Tell me what a country's consumption of sulphuric acid is, and I will tell you what her wealth is," will prove that he had no low estimate of the force of "chemicals" in trade. When the demand for "sulphuric," "citric," "nitric" and "oxalic' acids is brisk, when muriate, sulphate, arsenic, potash, borax, saltpetre, soda and sugar of lead are readily bought up, then general trade cannot be in a stagnant state.

BORAX

Is another "chemical" which is exported from India under the name of *tincal*, or rough borax. It is also brought from Ceylon, Persia and Thibet, the chief source of native borax being the lakes of these two

CHAPTER VII.

CINCHONA.

It is only of late years that so much has been heard of cinchona cultivation in India. The knowledge of the uses and healing properties of cinchona, or, as it is more commonly called, Peruvian bark, have been known, however, from very early times; for the native Peruvians were acquainted with the tree from which it was obtained long before its introduction into Europe. It was named by them *Kina* or *Kinken*. When the medicinal value of Peruvian bark first became generally known in Europe is a matter of uncertainty, but the Spaniards are said to have introduced it about the year 1640; and there is a fable extant, to which, however, the best authorities attach but little importance, that the beneficial power of the bark proved itself so eminently effectual in the cure of the vice-queen of Peru—the Countess Chinchon—that hence it was called after her, and thus we have the name of Chinchona or Cinchona. The Jesuits, however, put in a claim also to the discovery of the value of the bark of the cinchona tree, the power of which they ascertained by chewing. Its extreme bitterness made them fancy it would act as a febrifuge and prove a remedy in the cases of agueish fever so prevalent in the country. Finding on trial that this was really the case, they gradually made known the extreme usefulness and efficacy of the new

medicine, and in consequence of its being alone procurable through them it was commonly called Jesuits' bark. How we arrived at the knowledge of the power possessed by the bark of the cinchona species must be a matter left in doubt; but it is certain that its value as a tonic and febrifugal medicine can scarcely be overrated. Not only does it act directly on the nerves, but it affects both the vascular and muscular system, expedites the digestive and assimilating processes, and in fact improves the tone of the whole body, without interference with the brain functions by too rapid stimulating action. In tropical countries it is a downright necessity; for this reason the cultivation of the different cinchona species should be fostered and encouraged in India, particularly the *local* manufacture of the febrifuge, which is a great saving of expense to the Government, as, instead of the large importations of quinine from Europe, home-grown cinchona is found in every way to answer the same purpose and produce the same healing results.

Botanists have made the [illegible] study: but even amongst [illegible] considerable difference [illegible] of the various species. [illegible] teen different kinds [illegible] fifteen, while W[illegible] and [illegible] there are only seven and four [illegible] medicinal virtue.

It would be tedious to mention [illegible] ent kinds named in [illegible] now under cultivation in India [illegible] following table of [illegible] Plants [illegible] gives the most compact and [illegible] head:—

Species.	Botanical Name.	Commercial Name.	Value per lb. of dry bark in the London market.
.	C. succirubra	Red bark	2s. 6d. to 8s. 9d.
2.	C. calisaya		
	C. frutex	Yellow bark	2s. 10d. to 7s.
	C. Vera		
3.	C. officinalis		
	A. Uritusinga ...	Original Loxa bark	2s. 10d. to 7s.
	B, Condaminea ...	Select crown bark ...	2s. 10d. to 7s.
	C. Crispa............	Fine crown bark ...	2s. 10d. to 7s.
4.	C. lancifolia	Pitayo bark	1s. 8d. to 2s. 10d.
5.	C. nitida	Genuine grey bark	1s. 8d. to 2s. 9d.
6.	C. sp. (no name)	Fine grey bark	1s. 8d. to 2s. 9d.
7.	C. migrantha	Grey bark	1s. 8d. to 2s. 9d.
8.	C. Perusiana	Finest grey bark ...	1s. 8d. to 2s. 10d.
9.	C. Pahudiana	Unknown	Unknown.

The original cinchona of Peru, the Peruvian bark of commerce, is the *C. officinalis*, which is the kind chiefly cultivated and most suited for European quinine manufacture, as it is much richer in quinine than some of the other species. *C. succirubra*, according to Col. Dury, gives the greater yield of the two, but it is not so easy to work, neither does the sulphate of quinine contained in it crystallize so purely nor so thoroughly. De Candolle's description of *C. officinalis* is as follows:—"Tree: leaves oblong, acuminated at both ends, glabrous, shining, scrobiculate beneath at the axils of the nerves; limb of the corolla woolly; capsules ovate, twice longer than their breadth; stipules leafy, free, deciduous; flowers, terminal, in corymbose panicles, tube red, petals snow-white above; bark ashy."

Dr. Forbes Royle was one of the first to recommend the introduction of the cinchona into India; he urged the subject as early as 1835, when he published his work on Himalayan Botany. Little attention was then paid to him; but when the expense of importing

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glass; the great difficulty appears to lie in the proper hardening off of the plants when first raised; it is only by a careful course of hardening that they are enabled to endure the variations of the climate. In seed culture the seeds are sown in 2½-inch deep pots, bits of tile are placed over the drain-hole, a layer of brick dust is then put in, and then a layer of fine leaf-mould and sand, the mould being filled up to within half an inch of the pot's edge; water is given two, sometimes three times a day, and the temperature kept from 65 deg. to 70 deg. Fahr. In about sixteen days the seeds commence germinating. The plants, when they have thrown out two or more leaves, are moved into larger pots, prepared in precisely the same way. Great care has to be taken to preserve the seedlings from damp or mildew, and all spots appearing on the surface of the mould must be instantly wiped off. This precaution will be found to be daily required, or the young seedlings will damp off. When the plants have grown to about an inch in height they are put into hardening beds, and by degrees exposed to sun and air, until they seem comparatively hardy, when they are again moved on to the nurseries, where they are planted in rows four inches apart, in soil similar to that of the plantations into which they will be finally planted. In these nurseries they are at first protected by fern thatched *tatties*; but this shelter is gradually lessened and ultimately removed altogether, the plants having by this lengthy process become completely inured to exposure.

The treatment of cuttings from old stock plants is much the same. During the cold dry season the stock plants yield one crop of cuttings each month, and from May to October they produce two crops. The cuttings are planted in boxes holding 100 cuttings each, in coarse sand; these boxes are shallow and well drained.

to be planted at the end of May; while seed sown in January cannot be planted out until the end of June.

The sites chosen for plantations are usually sheltered from wind, as it is injurious to the plants. Soil, drainage and elevation, are all points for careful consideration. For red and grey barks the elevation generally selected is from 5,000 to 6,000 feet, while the brown and yellow kinds flourish at from 7,000 to 8,000, though they will grow and do well as low as 1,800 or 2,000 feet, the mean temperature of such places Humboldt estimates at from 17 deg. centigrade, or 62 deg. Fahr. to 12 deg. centigrade or 53·6 deg. Fahr.

In Peru, at one time, so much wholesale destruction of cinchona trees was carried on, that the trade in Peruvian bark almost came to a standstill, it being the practice of the Peruvians to strip the trees of their bark as they stood, instead of cutting them close to the ground and allowing a crop of young shoots to spring up from the old trunk, ready in their turn to be peeled. In India these valuable trees are now mossed every twelve months, this not only prevents waste, but renders the plantations more paying in a commercial point of view, as it increases the bulk of the bark and the yield of alkaloid per acre; it also facilitates the removal of the bark without injury. Until the trees have reached maturity the bark is of little value, after the felling the stripping process commences, and is done with a peculiar knife, the bark is cut lengthwise; the operation being one which requires great care, and considerable practice, as the rind must be removed without injuring the wood or severing the fibre. The strips are taken off as broad as possible, it is for this reason that a few days are usually allowed to elapse between felling and peeling; if the one follows the other too quickly the moisture that is found between

expense attending its use being far less than that of the imported quinine; in fact, it has been reckoned that Government would effect a saving of some 12,000 rupees annually by the use of this cheaper, and at the same time quite as effectual a febrifuge.

CHAPTER VIII.

COFFEE.

THE coffee plant is much more extensively cultivated in India now than formerly. Ceylon has for a considerable period been famed for its extensive coffee plantations; but in India the tree has not, until comparatively of recent date, been so much thought of. Now, in Southern India more especially, the acreage under coffee cultivation has rapidly increased, planters are more numerous, new districts are being planted, and the value of the Indian coffee rises yearly, being more generally and better quoted in the London markets. Mysore, Coorg, Nardoobatum, Wynaad and Travancore, are all good coffee districts, besides many other places.

With regard to the berry itself in its marketable state, all know what it is like: the plant or rather tree under cultivation is probably not quite so familiar an object. The *Coffea Arabica*, called also *Jasminum Arabica*, is a moderately sized tree, growing erect with a single stem to the height of from eight to twelve feet—in plantations the trees are stopped and stunted to between four and five feet—the branches are long, slender and undivided, bending downwards, the wood is limber and pliable, with a rough whitish bark. The leaves ever green, shining, oval and sharp-pointed, resembling bay leaves in appearance. The blossoms are white and fragrant, and very like the flowers of the

jasmine. It is usual to see the blossoms and fruit, both green and ripe on the trees at the same time. The fruit, first green, changes to red, which deepens into purple as it becomes perfectly ripe; in appearance it is like a cherry, the taste sweet, and the pulp of a glutinous nature, containing in it two hard oval seeds about the same size as a pea. One side of the seed is convex, the other flat, with a straight furrow deeply indented through its entire length. When growing the flat sides of the seeds are towards each other, and have a covering or membrane of cartilaginous skin which, when dry, is known as "the parchment." When quite ripe and fit to pluck, the red cherry-like berry assumes a purple tint; previous to this change taking place, the plants have to be most carefully protected from birds and monkeys, for unless kept off they will commit considerable damage to the crops, as it is a fruit of which they are especially fond.

In planting, the young plants—raised in the first place from seed in the nursery grounds—are inserted in holes from twelve to eighteen inches in depth, six or eight feet apart, to allow space for their spreading. New soil is most suitable for the proper growth of the plants, and the ground should be on a slight slope, which prevents any water lodging round the roots. In very exposed spots shading from the sun is necessary, as if the sun's rays beat too powerfully on the plants they are apt to scorch up. To give this requisite shade rows of thickly foliaged trees are planted at regular intervals all over the fields.

Coffee plants commence bearing when about two years old; but the quality of the seed from young plants is very inferior to that obtained from trees of four or five years' growth. The trees continue bearing until they are twenty or even thirty years old. The flowering time is of very short duration, but while

it lasts the plantations present a very beautiful sight; in one night the trees will burst into full flower and in the morning the whole plantation will look as if a recent and heavy snowstorm had passed over it, the contrast between the glossy dark green leaves and the snow-white blossoms being most marked and effective.

In Arabia the fruit is not gathered as in India, cloths being there spread under the trees, which are well shaken, the fully ripe berries dropping during the process. The Indian system of picking gives employment on a fair-sized plantation to three or four hundred hands; an able and industrious picker will account for from two-and-a-half to three bushels a day. The usual calculation is, that one bushel of perfectly ripe fruit will yield about ten pounds of saleable coffee. The size and colour of the bean, as the inner part of the seed is called, differ with different soils and localities; those trees planted in light gravelly soil, and in dry, exposed and elevated situations, yielding smaller berries than those grown in moist, shaded, and richer spots. The smaller berries are found to have the best flavour; but the weight of the larger produce is nearly double, and so, though the finer flavoured berry commands a better price, still the increase in price is not sufficient to cover the loss by deficiency in weight. The planter's interests therefore lead him to cultivate the larger, more paying, but less choice produce.

Considerable moisture is necessary to the welfare of the coffee plant; indeed, the planters say "the more it rains the better for the coffee;" and if natural moisture fails, then an artificial supply must be had recourse to.

When the coolies have finished gathering in the harvest, then follow the drying and pulping processes. Sometimes the berries are exposed to the sun in layers of perhaps five or six inches in depth on a platform:

the heat causes the pulp to ferment after the exposu has lasted two or three days; by this fermentatio a strong aciduous moisture is thrown off, after whic the fruit gradually dries for a period of three week The husks are then separated from the seeds in a mi Some planters remove the pulp from the seeds direct the fruit is gathered; and in this case a pulping machi is employed. This machine consists of a fluted hor izontal roller, which is turned by a crank and acts again a moveable breastboard, placed in such a manner that whole berries can pass between it and the roller. Aft this the pulp is separated by washing from the seed and they are spread in the sun to dry. Then the sk has to be removed, and to effect this the seeds are p in a trough in which a heavy roller runs. Mills of th are usually worked by bullocks. This treatment followed by winnowing to separate the chaff.

Coffee plants are subject to many diseases, of whi the worst is the "red rust," or "leaf disease." Ceyl has suffered much from this cause, so much so, inde that her crops have been year by year considerab [illegible], and her coffee industry thereby not a lit [illegible]. "Leaf disease" (*Hemileia vastatrix*) i a fungoid growth, which attacks the leaves a spreads rapidly through a whole plantation, complet changing the aspect of the foliage from deep glo [illegible] to dull orange, and deteriorating both the qual [illegible] of the berries. Quite recently experime have been made at the Peradeniya Botanical Gardens, a [illegible] with a view to the destruction of t [illegible] with flowers of sulphur. The action of t [illegible] is described as slow but sure, for it seems qu [illegible] its effect on the filaments and spores of t [illegible]. This experiment will prove of the great [illegible] and its results will be very genera [illegible] from time to time various different remed

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the heat causes the pulp to ferment after the exposure has lasted two or three days; by this fermentation a strong acidulous moisture is thrown off, after which the fruit gradually dries for a period of three weeks. The husks are then separated from the seeds in a mill. Some planters remove the pulp from the seeds directly the fruit is gathered; and in this case a pulping machine is employed. This machine consists of a fluted horizontal roller, which is turned by a crank and acts against a moveable breastboard, placed in such a manner that no whole berries can pass between it and the roller. After this the pulp is separated by washing from the seeds, and they are spread in the sun to dry. Then the skin has to be removed, and to effect this the seeds are put in a trough in which a heavy roller runs. Mills of this sort are usually worked by bullocks. This treatment is followed by winnowing to separate the chaff.

Coffee plants are subject to many diseases, of which the worst is the "red rust," or "leaf disease." Ceylon has suffered much from this cause, so much so, indeed, that her crops have been year by year considerably damaged, and her coffee industry thereby not a little weakened. "Leaf disease" (*Hemileia vastatrix*) is a sort of fungoid growth, which attacks the leaves and spreads rapidly through a whole plantation, completely changing the aspect of the foliage from deep glossy green to dark orange, and deteriorating both the quality and quantity of the berries. Quite recently experiments have been made at the Peradeniya Botanical Gardens, and other places, with a view to the destruction of this fungus with flowers of sulphur. The action of this remedy is described as slow but sure, for it seems quite certain in its effect on the filaments and spores of the fungus. This experiment will prove of the greatest use to planters, and no doubt will be very generally adopted. From time to time various different remedies

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planting of Liberian coffee; and in the new district of Rakwana the coffee crops are reported to be unusually fine, in some cases the yield being 10 cwts. to the acre.

In Ceylon the plantations have been threatened with a new and formidable enemy, which was discovered by Mr. Robb, manager to the Debeddie estate in Badulla. He at first fancied it was the "black bug," but on closer inspection found it to be the "lac insect." The effects it has on the coffee-tree are weakness of the branches, loss of leaves, and gradual death of the tree. The incrustation is very like old "black bug," but when rubbed between the hands "it is found to be an almost solid deposit of red gum, which leaves a carmine stain on the fingers." The celebrated Liberian coffee, already alluded to as having been recently tried successfully in Ceylon, continues to be reported of favourably, as yielding berries only sixteen months after being planted out.

Botanists enumerate several varieties of the coffee tree, existing in the Eastern and Western Hemispheres; it is most probable that such variations in the plant are owing to accident either of soil or climate. In America it is clearly shown that all the trees there are the progeny of one plant, which was as lately as 1714 presented by the magistrates of Amsterdam to Louis XIV.; it was planted at Marley under the care of Mons. de Jussien. And from it, some years after, plants were taken to Surinam, Cayenne and Martinico. In 1732 the production of coffee was considered of much value in Jamaica; the increase in coffee growing must, therefore, have proceeded with considerable rapidity. The use of coffee was known very early to the Arabians, the plant being in their country indigenous. All the chief authorities are agreed in attributing its introduction to Megalleddin, Mufti of Arabia Felix, who first learned its use in Persia.

With regard, however, to its first appearance in Europe there is considerable difference of opinion. In London, the first coffee-house was opened in George-yard, Lombard-street, by Pasqua, a Greek, who was brought over by a Turkey merchant called Edwards in 1652. And the first mention of the article in our statute books is found in the Act 12th Car. II. cap. 24 (anno 1660), whereby a duty of fourpence a gallon was imposed on all coffee made or sold. Charles II. attempted, but did not succeed, to put down the coffee-houses, which had in his reign become very numerous. The duty in 1732, I gather from McCulloch, was reduced to 1s. 6d. per lb. from 2s., at which it had previously stood. For many years, it remained stationary at the reduced rate, bringing in, on an average, £10,000 a year. In 1808 the duty was brought down to 7d. per lb., which had a beneficial effect in raising the revenue, a system of smuggling which had gone on during the years of higher duties having considerably [illegible]

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berries from Mocha, which he planted near his hermitage, about which are even now standing some very old coffee-trees. The earliest official accounts of the Mysore coffee-plantations are in 1822, when the revenue was under contract.

The exports of coffee for the last five years, according to Mr. O'Conor's recent review of the trade of British India, were as follows:—

Year.	Cwts.	Rupees.
1873–4	364,420	1,49,14,109
1874–5	311,831	1,30,53,346
1875–6	371,986	1,62,70,267
1876–7	302,489	1,34,58,217
1877–8	297,327	1,33,84,992

"The decrease shown in the two last named years was due to the drought in Southern India and the ravages of 'leaf disease,' the 'borer,' 'black bug,' and the 'lac insect,' which causes all combined to keep down the yield of the various coffee plantations. The two largest consumers of East Indian coffee are France and the United Kingdom, in both countries though coffee is now subject to heavy duties; 14s. per cwt., in England, and 156 francs. the 100 kilos in France when imported direct, an addition of 20 francs being made when the importation is made indirectly through a European entrepôt. The duty of 156 francs is equal to a rate of £3 5s. 5d. per cwt., not much short of 100 per cent. The English duty is at the rate of about 15 per cent. *ad valorem.*"

Coffee is sold in bond, and always at landing weights, and revenue tares no abatement of the duties being made on account of any damage the coffee may have suffered during transit. The business of disposing of the

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CHAPTER IX.

COTTON.

ITS GROWTH AND CULTIVATION.

THE cotton plant (*Gossypium herbaceum*) is indigenous in India. From the earliest times, five centuries before the Christian era, it was in domestic use in that country; the Hindoos having even in those days a thorough knowledge of the arts of hand-spinning, weaving, and printing cotton, and also of making the finest muslins. Both Arrian and Herodotus mention cotton cloths as among the articles brought by the Romans from India; Strabo and Mela also write of the substance. The *Sindon byssina* which Herodotus mentioned was most probably fine linen or cotton, the name *sindon* leading certainly to the supposition that the article was of Indian origin; for it is clearly a derivation of the name of the river Sindhu, or Indus. Fine muslins from India were worn by the higher class of Egyptians; and it is proved that they used cotton, because mummies have been found swathed in that material. In Sanscrit, cotton is called *kurpas*, and from that name comes the Latin word *carbasus*, found in old Latin authors; and in the Bible the word green corresponds to the Hebrew *kurpas*, being translated in the Vulgate *carbasinus*. The Arabs called the substance *kutn* or *kutun*, from which the word cotton is evidently derived. In Hindustani it is called *rùhi*.

There are many varieties of the cotton plant. Linnæus

writes of 5—1, *Gossypium herbaceum*; 2, *G. arboreum*; 3, *G. hirsutum*; 4, *G. religiosum*; and 5, *G. barbadense*. These are again divided into three chief classes, herbaceous, shrub, and tree, the most useful in commerce being the herbaceous species; the cotton from the West Indies, Brazil, and Egypt is from the shrub, and the older the shrub the coarser is the cott obtained from it. Tree cotton is of very slight mar able value. *Gossypium Indicum* has a branched st grows from one to three feet in height, is rich in fo age, with hairy palmate leaves, 3-5 lobed, lobes bro and rounded; flowers, which are axillary, yellow with a crimson eye in each petal; fruit, fibrous, capsules being oval, pointed, and 3-4 celled; seeds five, covered with greyish down under the short-stapled white wool. These pods come on as the flowers fade, and are about the size of walnuts; they contain the cotton fibres, vegetable hairs, of different lengths in the different varieties of the plant, springing from the surface of the seed-coat, and entirely filling up the cavity of the seed-vessel in which the seeds lie. As the capsule ripens, it browns, hardens, and expands, until finally the snowy fibres burst out ready to be gathered.

India possesses a soil and climate in every way fitted for the cultivation of cotton to an almost unlimited extent; the most, however, is not made. of its many advantages; owing to the rough method of cultivation, the absence of any true system of agriculture, the want of proper cleaning appliances, and the difficulties and high cost of transit, not a quarter of the amount of cotton is grown that might be; and lands which would be under a higher system of farming teeming with luxuriant crops, are allowed to lie waste. The ryots can produce cotton cheaply enough, the coarser sorts at 1½d. per lb.; but they do not consider it a profitable crop to grow, and rather than cultivate it at

a loss, allow the land on which they might easily grow it to lie fallow. Land in most parts of British India pays the same tax whatever may be the crop grown on it; uncultivated land paying no tax; the ryot therefore, rather than pay tax for land cropped with an article which does not reimburse him for his original outlay upon it, prefers that it should remain unfruitful and he have no tax to pay. Supposing he was to grow cotton, the tax on the land and the cost of transit on the cotton to the place of sale would swallow up all profits; until, therefore, inducements are held out to ryots to grow cotton especially, they will naturally neglect it for more favoured, because more profitable crops. If there was a certain and ensured market for the cotton when grown, and a more reasonable cost on carriage from the growing districts to the head centres of sale, then matters would be different, and the ryots might devote more energy to the growth and extended cultivation of the plant.

To command a better sale in England, Indian cotton must be sent there in a cleaner state, and cotton of better quality must be grown. Until this is the case the demand for it cannot be expected to increase to any marked extent. Want of capital here, as in the case of other Indian industries, asserts itself; it is poverty which hampers the ryots at every advancing step; proper and adequate machinery is needed for the cleaning of cotton; and though of late years improvements have taken place in this respect, much yet remains to be done before Indian cotton will hold its own in competition with the produce of America and other countries.

Cotton differs from other crops, such as sugar, indigo, tea, coffee, &c., because it is in itself, as Mr. John Chapman calls it, "a gross agricultural product," and has only to be separated from the seeds and cleaned before it is ready to come under the operator's hands

ances, which, though to us ensuring success, to *them* are only so many experiments the nature of which they do not, or will not, understand. They fail, therefore, to see the advantages which would accrue to them individually by the adoption of our new machines, and improved methods of cultivating the ground, having for its ultimate object the higher quality of the crops produced from it; and even did they appreciate them, they cannot afford to purchase. Cotton is grown in rotation with other crops. Sometimes it is planted with rice, the rice being reaped first; the crops are both planted at the same time: about the beginning of June when the rainy season commences; the rice is reaped in about three months, the cotton plant taking a longer time to arrive at perfection. When the rice harvest is over, the cotton bushes are just putting forth their yellow-petaled, crimson-eyed flowers. These are followed by the capsules containing the fibres, which as they ripen, brown, harden, and finally burst, showing their milk-white contents. Flowers, unripe seed-pods, and those with their snowy flakes of cotton visible, may often all be seen in the same field at the same time. In Dinagepore the cotton crop succeeds the rice, which is cut between August and September, instead of being sown at the same time. After the rice is reaped the ground is well ploughed up, as many as five or six double ploughings are given to it; the land is well manured, and in October or early in November the cotton seed, which has first been steeped for a certain time in water, is sown. There are two methods of sowing—broadcast, and in furrows, the latter method affording greater facilities for weeding and picking, as also allowing more air to the plants during their growth. From the middle of April to the middle of June, the cotton as it ripens is collected. Supposing the soil to be very rich, it is again sown with rice, th

maintain that sea air is the grand essential: certainly, large crops are obtained, and of the best quality, from islands and coast districts; but then the instances of heavy crops from inland districts are nearly, if not quite, as numerous.

In India the chief difficulty to be overcome is the want of sufficient moisture; and cotton, even the short-stapled variety common to dry lands, requires during its cultivation a more than average share of water. Proof of this is found by the examination of samples of cotton grown carefully in Indian gardens. Such gardens are always carefully watered by wells, worked by bullocks, resembling the time-old Persian *sakkais*—primitive, cumbrous affairs in use since the time of Candace. The bullocks walk round in a circle turning a pivot, which causes the wheel in the well to revolve; as it turns it draws up a rope ladder, to which are fastened a number of little red earthenware pots, called by the natives *chatties*. These pots come to the surface filled with water, and on reaching a certain elevation they turn over, pouring out their contents into a trough, which carries the water off to the main channel running the entire length of the garden. This principal trench is intersected by many shallow smaller trenches; these surround every bed or portion of garden to be watered; so that each in turn has the water let into it from the main channel, and the plot of ground it commands thoroughly watered, in many cases completely flooded, without any trouble on the *mallee's* (gardener's) part, beyond letting the water on, and damming it off when sufficient moisture has been given. Cotton grown under such circumstances improves in quality and in productiveness, and very favourable specimens have been obtained from gardens, showing what improvements can be effected in Indian cotton under a careful system of cultivation.

ITS COMMERCIAL HISTORY.

I have endeavoured to show in the preceding portion of this chapter how very early the Hindoos acquired the art of making cotton fabrics of various kinds from the cotton plant, its uses being known to them when other countries were quite in the dark as to even its very existence. Primitive though their processes were, from the cleaning of the cotton to its conversion into those beautifully fine muslins described as "webs of woven wind," they were effectual, and for the results of their labours the Indian weavers were justly celebrated all over the known world. They had no implements, with the exception of their hand-looms, worthy the name of machinery; and prior to the invention of these hand-looms for weaving, used only their fingers and the spinning-wheel. Yarn they spun on the distaff, and the patient and practised Indian spinner, by the wonderful and careful manipulation of finger and thumb in the formation of the thread, which acquired just the proper degree of moisture by passing through his hands, produced fabrics of surpassing fineness, unequalled indeed, until quite recently, by any machine-aided efforts.

An Indian loom consists of merely a few sticks and reeds, which stock-in-trade the humble possessor carries with him from place to place, so that he is ready at any time to fix it up and begin to work. He chooses usually a shady tree under which he can sit, digs a hole deep enough to hold his legs and the lower part of the *geer*, the balances being fastened to the branches of the tree above his head; underneath the frame he makes loops into which he places his great toes—the natives are quite as clever with their feet as with their hands—these serve as treadles, and his shuttle, which is merely

an enlarged netting needle, he uses as a *batoon*. A loom of this sort has no beam, and the warp is laid out on the ground the whole length of the cloth. The very finest Indian muslins come from Dacca, Shantipoor, Sonarga, and Vicrampoor. The price of a single piece of this very fine muslin, which takes an Indian weaver four months to produce, will sometimes amount to 400 or 500 rupees. The striped and flowered muslins of Dacca were formerly considered inimitable, and were so very much thought of and sought for by the higher classes in India that the demand was greater than the supply.

The great skill attained by Indian weavers is not difficult to account for: weaving is an hereditary art, the same trade going down from father to son for generations. The father teaches his son while young the mysteries of his employment, and the weaver, beginning to practise his trade at an early age, soon becomes a proficient in the art, and, with the most simple appliances, turns out the very finest work. I write of years gone by; now the excellence of our machinery, brought as it is to the highest perfection, has not only enabled us to compete with native hand-workmanship, but to outstrip it. England has long ceased to depend on India for her fine muslins, and instead of importing such piece-goods from thence exports them thither. The art of manufacturing these extra fine materials has therefore languished of late years; still, neither English nor Bombay mills have, so far, entirely displaced those hand-made goods which once were so famous. Formerly, Arabia, Syria, Persia, Egypt, Abyssinia, the eastern parts of Africa, besides Europe, were all supplied with muslins from India; the chief marts being Surat and Calicut on the West Coast and Masulipatam, Madras, and St. Thomé on the East Coast. Now, the natives confine themselves chiefly to

piece-goods, clamoured for some check to be placed on it, as they fancied that the cheapness and quantity of these goods would undermine their own trade. In 1701, therefore, an Act of Parliament was passed to forbid Indian silks and printed calicoes for domestic use being imported either for wearing apparel or furniture; and very heavy penalties, in some cases as much as £200, were, we learn, imposed on seller or wearer "to avert the ruin of English manufacturers and revive their prosperity."

In those days such an alarm being raised seems rather astonishing; for even taking into consideration the extreme cheapness of Indian labour, and the beauty and fineness of their cotton and muslin piece-goods, without mills—for there were none in India then—the Indian natives could not have stood competition with English firms, who, backed up as they were by wealth and power, could afford to buy up Indian cotton *raw*, ship it thousands of miles to manufacturers, mix it with cotton from other countries—notably American cotton—and then send it back in piece-goods to the very country from whence it originally came. In these days, however, when Indian cotton mills have increased to such an extent, and protected as their productions have been by the duties, against which so much has lately been said and written, there is far more reasonable cause for alarm: but to this subject I intend to refer later on.

Royle tells us that "cotton was first imported into England in 1783, when about 114,133 lbs. were received." But as early as 1684 considerable attention was paid to the exportation of the raw material, and attempts were even then made to save the cost of freight by compressing the cotton into bales by machinery. Many and great improvements have been made in the cotton screw since that date; and such immense pressure is now

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the American war broke out in 1861, and between that year and 1865 when our supply from America was cut off, then indeed were halcyon-days for Indian exporters; and Maclean puts the average value of the cotton exports for those five years at a yearly average of £21,582,847 for Bombay alone. Then began those speculations which ended so disastrously in the Bombay Panic.

Companies of all sorts and kinds were formed, joint stock banks, financial associations, and land companies. But when the American war ended, then came the total collapse of those Bombay speculators who had plunged so wildly. By the end of 1866 the financial associations had failed or gone into liquidation, the banks, with one or two honourable exceptions, were blotted out of existence, the land companies became insolvent, and there was one general crash. Maclean has in his "Guide to Bombay" a very interesting account of that city during this season of panic and confusion. As Bombay had had the chief benefit of the wonderful increase of the cotton export trade during the years mentioned, by which some seventy-five millions sterling came into her coffers and gave her the speculation fever, so she was the chief loser by those suicidal undertakings into which the sudden accession of such a vast sum had hurried her.

This panic did not, however, affect her permanently; for in 1874-5 her cotton exports had increased from 34 to 50 million pounds, and the monetary value from $9\frac{1}{4}$ to $12\frac{1}{2}$ millions sterling.

The cotton mills of Bombay, the first of which was started in 1854, have made since that date very rapid progress. No less than 41 spinning and weaving mills in the Bombay Presidency are at work now, and more in the course of erection; while in Calcutta there are 5, 2 in Madras, 2 at Cawnpore, 1 at Nagpore, 1 at Indore,

and 1 at Hyderabad in the Deccan, or 53 in all In These mills give work to 10,533 looms and 1,289,700 spindles, and are nearly all conducted under skilled European supervision. There is to each mill a manager, weaving master, spinning and carding master, and an engineer. The mills are further managed by a chairman and board of directors, with the assistance of a secretary, there also being an agent. The latter's work is most important: he purchases the cotton, the coal for working the engines, the stores needed, and all other necessaries, arranging moreover the sale of the cloth and yarns. Skilled English labour commands a high price, from 200 to 400 rupees per month, sometimes running as high as 500 rupees. In some few mills the managers are natives, and before long this will be the case in many more instances, for young natives are now very frequently found serving an apprenticeship in large cotton-mills with a view to qualifying themselves for the posts of managers at some future period. Indian labour is, however, as yet far inferior to English, the rate of pay is lower, and therefore the work is done more cheaply, but a native's *physique* is far below an Englishman's, and he is not equal to the same amount of sustained work. The following extract from Maclean's "Guide to Bombay" will be found of interest:—"A middle-sized mill, say of fifteen lakhs, having 30,000 spindles and 600 looms, employs on an average 1,000 people, whereof 100 or thereabouts are boys and girls, 100 women, and 800 male adults. The hours of work are from 6 a.m. to 6 p.m., with an hour for recess in the middle of the day for meals and smoking: nearly every mill has a smoking-shed. Fresh Vehar-water is freely supplied to all operatives, and generally they are all well cared for, much better than work-people employed in other industries in Bombay.

The average wages earned by the various mill operatives are as follows:—

Wages	Per Month.
For each boy or girl	5 Rupees
For each female	8 „
For each male	16 „

The head jobbers earn as much as 70 and 80 rupees a month. On an average a mill of the description named above, namely, one having 30,000 spindles and 600 looms, would consume per month—cotton 288,000 lbs.; coal, 286 tons; stores and other articles worth 8,000 rupees, and would pay wages to labourers amounting in round numbers to 13,000 rupees. It would produce 220,000 lbs. of yarn and 200,000 lbs. of cloth per month."

The treatment of the Indian operatives in cotton mills has recently been brought before the public. Certainly the factory rules and regulations in India stand in need of much amendment, the hours being too long, particularly for women and children, and the latter being employed to work in mills at too early an age: this, however, is scarcely a question to be dwelt on here, when the commercial history of the Indian cotton trade is the subject of consideration. It must, therefore, be left in the hands of those who have agitated—it is to be hoped with success—for the amendment of the Factory Acts in India, and considering that some 40,000 natives are employed in Indian factories it is none too early to investigate more thoroughly, and strive as far as possible to ameliorate their present condition, by regulating their hours of labour and of recreation, and restricting the age for children commencing work to eight; instances having been given in which mere infants of the tender age of

five years were set to labour hours at a time in cotton mills.

Bringing the exports of cotton down to date, we find that for the last five years the exports of raw cotton have been as follows:—

Year.	Cwts.	Rupees.
1873-74	4,499,698	13,21,22,409
1874-75	5,600,086	15,25,73,416
1875-76	5,009,788	13,27,89,635
1876-77	4,557,914	11,74,61,836
1877-78	3,459,077	9,38,35,340

The above figures, which are taken from Mr. O'Conor's "Review of the Trade of British India for the official year 1877-78," show plainly the downward course of the last three years. The quantity shipped to the United Kingdom has been ever since 1871-72 falling off each year, England being no longer so large a customer for Indian cotton as she once was. Austria, France, Germany, and Italy are, however, maintaining a fair demand for the article, and their yearly consumption of the Indian raw material is increasing slowly but surely; while the China trade is again looking up, she having taken some 209,000 cwts. in the year.

With regard to manufactured cotton the following figures, taken from the same source, represent the value of cotton twist and piece goods exported by India to foreign countries during the last five years:—

Year.	Rupees.
1873-74	52,26,298
1874-75	51,23,752
1875-76	66,34,236
1876-77	81,23,822
1877-78	1,14,27,323

At first sight Mr. O'Conor says, "these figures, as showing that the trade has doubled itself in five years, would be taken as a gratifying indication of the flourishing condition of the cotton spinning and weaving industry in India." He goes on to show that such, however, is not the case, the Indian cotton mills having had in recent years much to contend against. Over production in Lancashire, which glutted the Indian markets with Manchester stock; and the failure of crops, which was caused by drought, impairing the purchasing power of the people, are the chief causes of the trade being unfavourable to the Indian mills; the increase noticeable in the exports being accounted for by the fact, that the mills, having accumulated large stocks, were obliged to get rid of them at considerable loss in point of value, the exports being increased really by sacrifice of goods.

This increased export, however, has again exercised the alarm of British manufacturers. The *raison d'être* of these renewed fears on the score of Indian competition form the subject of the concluding portion of the chapter on this particular industry.

INDIA V. MANCHESTER.

Before entering into this subject it is necessary to give a cursory glance at the vast importance of the British cotton trade. I am dealing nominally with only Indian industries; but the two trades are to a certain extent inseparable, and more especially intimate have their relations become during the last century.

The precise date of the commencement of the cotton manufacture in England has never been confidently fixed, though most commercial writers agree that it was introduced in the early part of the seventeenth century. The total quantity of cotton imported by the

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asserted we must bear in mind that though substantially correct as to the bulk and weight of goods exported being greater than that retained in the country, the goods kept for home use are more costly, being of a decidedly superior fabric to those turned out merely for exportation.

For the following table I am indebted to the famous commercial authority quoted above:—

COTTON.

The total quantities and values of the raw cotton imported into the United Kingdom in each of the five years ending with 1875 were as follows:—

Year.	Cwts.	£
1871	15,876,248	55,907,070
1872	12,578,906	53,380,670
1873	13,639,252	54,704,847
1874	13,989,861	50,696,496
1875	13,234,564	46,259,822

The chief supplies having been obtained from the United States, British India, Egypt, and Brazil.

Our large manufacturers will pass through from time to time seasons of alarm, gloomy fears will arise, and mountains be made out of molehills—this is even now the case with the Indian cotton trade. I have shown how in 1701 a similar feeling became general, how an outcry was raised, and an Act passed to protect the British manufacturer from the bogey of his own creation, how his fears subsided, and the competing export trade, he so needlessly dreaded, dwindled down to a mere nothing. Now there is more solid ground for alarm, trade has been in an unquestionably depressed state. But has

much talked of Indian cotton duties, and thereby caused so much ill-feeling in both countries. Neither is it at such a time that Manchester cotton lords should insist so strongly on their so-called rights, and accept the surrender of the £750,000 which the import duties yielded to India, when that country is acknowledged by all authorities on the subject to be in financial difficulties, and labouring under "one of the heaviest deficits that ever perplexed a finance minister." * Such a reduction in the Indian revenue can only be met by a fresh tax. The cotton duties, however much may be said to the contrary, did not press very heavily on the Indian native; for those duties were only levied on the finer kinds of cloth, and these were goods only used by the richer natives, not the material from which the masses of the people made the *dhotees* which serve them for their scanty garments; these are now, by the remission, increased in price instead of lowered. "This repealing of the import duty upon cotton goods is one of the latest grievances Indian people have to complain of;" at least, so says Mr. Lalmohun Ghose, whom we may reasonably conclude knows the state of public opinion amongst his own countrymen better than we do; and he openly stated that the people of India—meaning presumably the educated natives—have come to the conclusion that "the interests of India had been sacrificed to consolidate a powerful party in England in view of the coming election." It is easy, no doubt, to impute interested motives; but where there is much smoke, the old adage says, there must be some fire.

How far the remission of the cotton duties will benefit those who have so long been working to obtain their repeal, is an open question. The writer of an article in the *Pioneer Mail*, commenting on Messrs. Hope and

* Written in 1879, alluding to the Budget of that year.

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must, to please Manchester mill owners, be got into India free from duty. The 1878 notification was not extended to "shirtings," and so duty had to be paid on this class of goods even when they were made of coarser quality than 30's. In the Budget of last year, the notification "exempting from import duty all cotton goods containing no yarn of a higher number than 30's" will let in these "shirtings," on which so much stress is laid; only they will have to be made of a rather coarser texture than has hitherto been the case. Manchester will now manufacture "shirtings" of yarns of 28 or 29, which will be imported free; they will be offered to those classes who have hitherto bought Indian long-cloths; they will be of a better quality than those of the Indian make, and rather more expensive; but they will command a sale. The Commissioner of Customs of Bombay holds this opinion; and if his idea is a correct one the present remission will in reality do little to benefit Manchester, for this reason—it will not enable her to contend with the Indian mills in respect to the precise class of goods they are turning out. The Indian market will be flooded with the new class of shirtings from Manchester, which will increase, instead of in any way lessen the depression under which Bombay and India generally are now suffering. It will be urged that Manchester is also suffering from a depression of trade, and that her interests have to be considered, and first of all; but Indian trade is not the cause of Manchester's depression: its causes lie beyond India, and the burden cannot justly be cast on her, the depression of the English cotton trade is one of the consequences of that general stagnation into which trade has fallen all over the world, but is happily now recovering from. There are causes and second causes, wheels within wheels, in the vast commercial transactions of the present century; every

labour, and quantity and cheapness of mat country can in reality compete with us; and having passed the extreme point of our trade, energy will gain for it a higher point than reached before any real descent can take pla British energy must be rightly directed; selfi row-minded jealousy must be laid aside, more larly with regard to India. That country ha spoken of as "the brightest jewel in the Crown;" our own actions must not dim that lustre. If Indian interests and English intere come to be considered identical and therefore parable, then trade jealousy, which is the real between the two countries, will be laid low; and Metcalfe's prophecy "that India would be lost floor of the House of Commons," *i.e.*, sacrificed to interests—will stand no chance of fulfilment.

Cape Colony, but has now for a very long while been quite naturalised in both the East and West Indies. The *Aloe vulgaris* has a short stem; fleshy leaves, which are lanceolate, flat, armed with reddish spines, and blueish green in colour; the flowers, which at first are erect, afterwards spread and become pendulous, they are yellow, with three inner segments of a deeper and more orange colour. The substance it yields is dark brown, sometimes reddish brown, and is excessively bitter to the taste, and unpleasant to the smell. It is in reality very far below the Socotrine aloes, though lately owing to their scarcity it has gone up in value. *Caballine*, or horse aloes, is the refuse of Barbadoes aloes, and is obtained by boiling the leaves of the *Aloe vulgaris* after the finer sort of aloes has been extracted from them. It is only used by veterinary surgeons, is very rank, and has a most unpleasant odour, by which it can be easily distinguished. Cape aloes are procured from the *Aloe spicata*, which is indigenous in Cape Colony as it is in Arabia. It is yellow in colour, and has, too, a most disagreeable smell. There are other species yielding aloes, Royle mentions the *A. Indica*, and Roxburgh the *A. perfoliata*, which are both found in the dry sandy plains of the North West Provinces; in the sea-coasts another species is found, the *A. litoralis*, which produces a very good sort of aloes particularly valued by the natives, for the juices they extract from its leaves is considered a good remedy in ophthalmic cases, and it is impossible to travel far in India without discovering how valuable any effectual cure for this disease, which is so sadly prevalent, must be. There are many ways of preparing aloes, the most general being to cut the leaves off at their base, and place them in iron vessels to drain; when they have discharged all the juice it is exposed to the sun, or to artificial heat, by

which process the aloes become inspissated. Another method is to make transverse incisions in the leaves and scrape off the juice as it flows. In preparing horse aloes from Barbadoes aloes, the leaves, after the juices have been extracted from them by the above methods, are cut into slices and boiled from ten to fifteen minutes, after which the water in which they have been boiling is evaporated. Occasionally pressure is used even in procuring the juice in the first place; but it is very much deteriorated when this is the case, as the mucilaginous matter, of which the leaves contain a great deal, is thus mixed with the bitter juice, which thereby loses much of its power.

The American aloe (*Agave Americana*), though having medicinal properties, is more known as a fibre-yielding plant, and I have therefore included it under the head of "fibrous plants." Aloes-wood will be found under the head of "spices." It is difficult to find any reliable statistical information respecting "aloes," the different species being generally [illegible] under "drugs." McCulloch gives the following figures for the three years ending 186[illegible]:

Years	Quantity	Value
18[illegible]	[illegible]	[illegible]
18[illegible]	107,[illegible]	[illegible]
18[illegible]	[illegible]	[illegible]

As representing the quantity of aloes imported to the United Kingdom from India.

CINCHONA, see Chapter [illegible].

SENNA.

Cassia lanceolata, Indian or [illegible] senna, is indigenous in [illegible] [illegible] [illegible] [illegible]

quently made on the leaves, and they are said to be quite as efficacious as the Egyptian and Italian leaves of the best sort, and superior to those brought from Mocha. A great deal of senna is now grown in Southern India, and is imported from Calcutta and Bombay. Samples of Tinnevelly senna were sent to the Madras Exhibition in 1855, and reported on favourably; since that time a great deal more attention has been paid to the cultivation and rearing of the plant, and the senna leaves imported from Southern India are highly thought of in England.

Senna is very extensively used in medicine, in 1867 the imports of senna amounted to 704,305lbs. There was formerly an import duty levied on the leaves; but after being reduced in 1832 and 1842 it was finally repealed in 1845. The infusion is prepared by pouring cold water on the leaves, and letting it stand for twenty-four hours with the air excluded.

Cassia alata, *C. absus*, *C. auriculata*, *C. occidentalis*, *C. sophera* and *C. tora* have all medicinal properties, the leaves of some of the species acting precisely in the same way as ordinary senna.

INDIAN JALAP.

The *Ipomeœa turpethum* which grows on the Coromandel coast is an excellent substitute for real jalap, having the same valuable medicinal properties. Though still much used among the natives, in European practice it has fallen into disuse.

Amongst the other "drugs" found in India I may mention—" castor oil " (see " OILS "), *Strychnos colubrina* (Linn.), considered the best remedy for snake bites, it yields the real *Lignum colubrinum*; *Strychnos nux vomica* (Linn.) or vomit-nut *Strychnine* is a preparation of *N. vomica*, a considerable quantity of its seeds

Cowage, *Mucuna pruriens.*
Pomegranate, *Punica granatum.*
Galls, *Quercus infectoria.*
Tamarind, *Tamarindus Indica.*
Dandelion, *Taraxacum dens-leonis.*

It would be impossible to name all the various shrubs and trees which the natives use in treating different diseases; for rheumatism, they have many remedies, chiefly oils which are produced from different seeds, as well as various lotions they make in cases of ophthalmia and use with varied success. No country in the world is so rich as India in useful vegetable productions. A good insight into their variety and their different properties will be gained by studying Colonel Heber Dury's "Useful Plants of India," a book I have frequently laid under contribution in these pages.

CHAPTER III.

DYEING AND COLOURING MATERIALS.

ARNATTO.

THE arnatto, arnotto or annatto, as it is generally ...elt, tree, the *Bixa orellana*, is a native of South ...merica, Jamaica, and other parts of the West Indies, ...so of Java and Sumatra. The East Indian variety is ...t thought so highly of as the West Indian and Ameri...n, because the dye obtained from it is said not to be durable, and the arnatto [illegible]

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tents. Directly the pods are quite ripe they are gathered, stripped of their husks, and well bruised. The pulp surrounding the seeds is the portion of the pod containing the valuable arnatto dye of commerce; it is extracted by bruising and macerating the pods in water, they are left in just enough water to cover them for some days, or until the fluid begins to ferment, it is then thrown off, and the pulp allowed to subside. Sometimes arnatto goes through a beating process, similar to that employed in extracting indigo dye, before it is finally allowed to settle. The pulp which remains is then placed in shallow pans and left to dry in the shade. If it has been thoroughly well prepared it will be of a bright yellow colour, that is the American and West Indian arnatto, the East Indian has a rose-coloured dye prepared from it, so says Colonel Dury in his account of the substance in "The Useful Plants of India." At the Madras Exhibition several specimens of arnatto dye were shown.

Formerly arnatto was obtained by a much more tedious process than now prevails, which was first introduced by Leblond, and consisted in merely washing the seeds until all their colour was extracted, precipitating the colour with vinegar or lemon-juice, boiling it up to facilitate the removal of impurities with the scum, and then draining it in bags. M. Vauquelin made several experiments on the arnatto pods, and quite confirmed the efficacy of these simple measures, which really enhanced the value of the dye and made it even of more decided use to dyers. As arnatto is not easily soluble in water alkalies are generally employed to hasten its solution, potass being most generally used; they also improve the colour of the dye; it is perfectly soluble in alcohol.

The roll arnatto is the most valuable form in which the substance is imported, as it is much harder than the

resolve itself into less careful preparation. The use of arnatto has increased very much indeed of late years. In 1820 not more than 50,000 pounds were imported, now the consumption is at least three times as much or even more; but a considerable quantity is re-exported.

GAMBOGE.

Though properly speaking gamboge is a pigment, I have considered it under the head of dyeing substances, because the colouring matter which it contains is used not only in painting and lacquering, but also by the natives for dyeing cloths.

It is a concrete vegetable juice, which on exposure to air hardens into a resinous gum. The best gamboge comes from Siam, and is obtained from a tree called *Stalagmitis gambogioides*, which is a native of Siam, Ceylon and Cochin China.

Many species of gamboge-producing trees are found also in India, the *Garcinia gambogia*, found in the Neilgherries; the *G. pictoria*, or Mysore gamboge, found in Mysore in the Wynaad forests; the *G. elliptica*, a native of Silhet; the *G. purpurea*, found in the Kandalla ravines; the *G. cowa*, at Monghir on the Ganges; and *G. lancæfolia*, *kydia*, *pedunculata* and *paniculata*. These species all yield fruit, mostly edible, and a yellow juice which flows from their barks on deep incisions being made, and which hardens very soon into a substance bearing the closest resemblance to the gamboge of Siam. All these trees were called *Garcinia*, after the name of Dr. Garcin, who was a great East Indian traveller. They were supposed at that time to belong to the natural family of *guttiferæ*; but Professor Graham, of Edinburgh, established the new genus of *guttiferæ* called *Hebradendron*, and the Ceylon gamboge is known under the name of *H. gambogioides*. It is,

however, inferior to the Siam, probably because it is less carefully prepared for the market.

The pipe gamboge of Siam, so called because it is preserved in the hollows of bamboos, is considered the best which comes into the London markets, and commands the highest price. It is obtained by breaking off the leaves and young shoots of trees, the juice then exudes in drops or tears, which are rolled into bamboos.

It is thought by authorities on Indian subjects that the gamboge, obtained from the Mysore and Neilgherries trees, the *Garcinia gambogia* and *G. pictoria* before mentioned, is scarcely if at all inferior to the Siam and Ceylon productions; and though the trees are certainly different, the juices obtained bear a very strong likeness in every particular. The Neilgherries tree is called by the natives *Heela*, and it is said to produce 75 per cent. of colouring resin, ordinary gamboge yielding from 40 to 75 per cent. In the Coorg and Mysore countries Dr. Cleghorn has personally examined the trees and the gum obtained from them. "They grow," he says, "at a range of elevation between 2,000 and 3,000 feet. The quality of the specimens of gamboge which he obtained were all in a concrete state, of a tawny, brownish yellow colour, and glistening waxy lustre exactly like fine Siam gamboge, and showing its tendency to conchoidal fracture, free from odour, tasteless, and equal to the Siam gamboge in being easily reducible to a fine emulsion in water." Moreover, analysis has proved that the gum is precisely the same as the Ceylonese, only it contains rather more colouring matter, more resin, and less gum; therefore one would think more valuable than the gamboge of commerce, which chiefly comes from Siam and Ceylon. This is an industry which in India wants opening up; for the natives, though using the gum for dyeing and medicinal purposes, do not seem aware of its value as a

pigment, neither do they understand its preparation for English and foreign markets; it figures to a very trifling extent in India's exports, and it certainly might and should become of more importance.

Gamboge has been known in Europe ever since 1603, when it was introduced by Clusius. It was formerly called Camboge, from the province of Cambodia. Since its first introduction, it has rapidly increased in commercial value, and the price it now fetches is from £12 to £20 per cwt.; in 1866 it fetched upwards of £24 per cwt., and the quotations for this year (1879) are £20 10s. to £20 15s. per cwt. It is not soluble in water, but diffusible, forming an emulsion. Alcohol is an efficient solvent, for it readily takes up gamboge in large quantities, and forms with it a clear golden coloured liquid, which is that chiefly used in brass lacquer-work. Gamboge forms the chief ingredient in many lacquers, such as lacquer for brass, pale gold lacquer, green lacquer, and lacquer for instruments, Chinese lacquer work, &c. It is also much used as a water-colour pigment, and is besides a powerful medicine, which requires to be administered with considerable caution.

Resin is the most active principle in gamboge, the Siam pipe yields 72·1, the cake gamboge of Siam 64·8, and the Ceylon gamboge 75·5. The cake gamboge here mentioned is not a natural production, but is manufactured.

HENNA.

Lawsonia alba, which both Lamarck and De Canolle agree in saying is the same as that called by other botanists *L. spinosa* and *L. inermis*, because when young it is unarmed and when old becomes thorny from the younger branches hardening, belongs to the genus of plants of the natural family of Lythrariæ, and is

indigenous in India, Egypt, Persia, and Syria. The henna plant is a shrub growing from six to ten feet in height, the stem and branches are covered with a greyish bark, the flowers, which are white and extremely fragrant, grow at the extreme ends of the branches in long clusters, the corolla consists of four petals. The calx is divided into four segments, the leaves are long and oval, of a pale green colour and grow opposite to each other on the branches; the fruit is green at first, but as it ripens becomes darker in hue by degrees until it is quite red, this colour changing to brown when it is dried. The time for flowering is from May till August.

It has long been the custom amongst Eastern women to dye themselves with henna, the nails, tips of the fingers, and soles of the feet, are usually so stained, and sometimes the eyelids. The orange colour imparted by the henna lasts for three weeks, sometimes a month, when it has to be renewed. Poets—Arabian poets in particular—have made us well acquainted with this custom, and most oriental travellers allude to the Eastern women enhancing their charms by using yellow and orange dyes.

Henna is, however, not only used in the East as an indispensable toilet requisite, but as an ordinary dye as well, various materials being dyed with it; the colouring matter the leaves produce is a reddish brown substantive dye. The leaves are the only part of the plant used; after they have been gathered, they are quickly dried, bruised, and made up into a paste, or sometimes merely dried and pulverised. By boiling the paste, the colouring matter with which the leaves are charged is yielded. The natives [illegible] occasionally dye the manes and tails of their horses with henna, and it has medicinal uses as well, being considered an excellent remedy in leprosy, which is so prevalent in

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India and other Eastern countries; the leaves are also applied externally in cases of skin disease. As a dye it is little used out of the country, and in it it is falling into disuse, other red brown dyes having almost superseded it.

INDIGO.

The knowledge of the manufacture and use of the indigo plant dates back to a very early period, though its real nature was unknown to Europeans until long after its use was thoroughly understood in India, the place of its production, a country which has always been famous for the number and excellence of the different substances for dyeing various colours with which it abounds. The natives of India have been celebrated from time immemorial for their skill in the useful arts, their attention having been given to the manufacture of dyes long before other nations were even acquainted with the various plants from which colours could be obtained.

Pliny mentions *indicum*—the deep blue dye of the Romans so highly valued—in his Hist. Nat. (lib. xxxv. c. 6, 27). Dioscorides writes of *indicon*; and in the "Periplus" of Arrian indigo is mentioned as being exported from "Barbarike on the Indus to Egypt;" it was certainly imported into Europe *viâ* Alexandria before the Cape route to India was discovered. Marco Polo not only writes of the substance called indigo, but explains how it was manufactured; though many held in those early ages, before any real knowledge of the plant was acquired, that it was a mineral instead of a vegetable substance.

For a long while the indigo grown in Central America was considered superior to that raised in the East Indies; but from the commencement of this

present century the cultivation of the plan preparation of the dye obtained from it, hav rapid strides in India, and the importations from are considered to be the finest in quality, comm the best price in European markets.

Indigo is grown, though, in many places besides East Indies; in China, Cochin China, North and America, Mexico, Guatemala or Central Americ Jamaica, Japan, Java, and in Madagascar. In cal countries the different species of *Indigofer* to flourish. Edwards, in his account of the Indies, calls it "the child of the sun." The temp ture must be higher than 60 deg., or it does not flou well.

The Indian indigo plant, *Indigofera tinctoria*, shrubby, bushy plant, with a stem of from two four feet in height; it has a root of some quarter an inch in thickness, and about fourteen inches in length; the stem is devoid of pith; the leaves are winged, oval in form, smooth, furrowed on the upper side, and darker than on the lower side in colour; the flowers are very small and have no smell. When the plant is in flower it contains the most colouring matter. There are about 150 species, but all are the same, small, bushy, herbaceous plants; the best known are *I. tinctoria*—the one now under notice as being the most generally cultivated in India—*I. anil*, *I. cœrulea* (Roxburgh), *I. argentea*, and *I. disperma*.

In India indigo is chiefly cultivated in Bengal; though it is grown also in many other parts, in Madras, Kishnagur, Tirhoot, Jessore, Moorshedabad, Gujerat, Agra, Oude, Behar. The Madras indigo is decidedly inferior to that grown in Bengal. The latter growth are divided into two classes, "Bengal" and "Oude." The first, comprising the trade from the Bengal and Bahar Southern Provinces, the second

that from the Northern Provinces and Benares. Good indigo should on being rubbed with a hard body assume a fine copper-red polish; it is also known by its lightness, and by the intensity and purity of its colour. Bengal indigo is known in the trade by the following terms deciding its quality:—"Fine," "middling and ordinary," "low and ordinary," "Madras," "Oude," and "Kurpah," being usually quoted under their respective names, which sufficiently denote their quality.

In Bengal the ground is broken up to receive an indigo crop in October or November. This is after the last crop has been cut. In former times one sowing was made to yield three or four crops, a process alike detrimental to the quality of the crops, and the fruitfulness of the ground so exhausted; now rarely more than two flowerings are allowed from the same root. The stubble is left about a foot high, in preparing for the spring sowing this stubble is cut out and gathered up by the natives for fuel. The soil is then turned up with the *kodali*, a sort of hoe. It is then pulverised and flattened by the *hengha*, a very primitive kind of harrow; and then commences the ploughing with ploughs, which would cause the greatest astonishment to the worthy "Hodge." They do their work fairly well though, rude as they are, and however much their appearance may be against them. Ploughing is followed by another touch of the *hengha*, and then the ground is thoroughly beaten by a perfect army of coolies with big sticks. This first cleaning of the land is termed *oustennie*. The whole process of ploughing, harrowing, and beating is repeated three times until the land presents a thoroughly clean look, and its whole surface is quite even and ready for the sowing, which usually takes place in February; and sometimes prolonged even into May, according to the nature of the season.

The seed is sown—the drill being now in more general use than formerly, that is on lands where high farming is practised—in straight furrows about a foot apart, about 8lbs. of seed going to the *beegah*. After the young plants begin to show, which they do from within nine to fifteen days, sometimes as early as seven, constant weeding and hoeing go on, the finishing touch being termed *bedaheunee*, consisting of a very light ploughing round the roots of the plants.

Indigo plants are subject to blight (*lahee*) scorching (*ihirka*), caterpillars (*piloor*), besides other ills, which make indigo farming rather a precarious industry. If all goes well the little red flowers appear in June, the leaves turn yellow, and the crop is ready to be gathered in. It is cut within a foot of the ground, and the plants—called in this state *pât*—collected in bundles and delivered at the factories.

Indigo is grown in three ways:—1st, Jamiwar or Ryotty; 2nd, Zeraat or Zerat; 3rd, Khuski.

By the first method the planter purchases or takes a lease of an estate, collects his rents from the various villagers on his land, and acquires for the time a landlord's privileges. He persuades the ryots to grow indigo on their lands or a portion of their tenures. Under this plan the cultivator bears all the expenses of ploughing, sowing, weeding, cutting, and delivering the plant at the factories, receiving the seed from the factory, and an advance in money towards the expenses of cultivation.

Under the *Zeraat*, all the work is done by the planter's own hired coolies, and the entire expenses borne by him only.

While the *Khuski* system is simply giving advances to ryots outside the landlord's own tract of farm, and

their growing a certain amount of indigo, at a certain rate which they contract to deliver to him ready to be manufactured.

Factories conducted on a large scale cannot fail to give a good interest for the money invested in them. It is the ryot who suffers in a bad season. They say, "Indigo is a fine thing to put money into the purse of the *baboo*, but the poor people do not want to see it, it raises the price of rice, and the rent of land." The small owners argue in this way when they have entered into a contract with a planter to deliver to him so much *pât*, and accept his advances for bullocks, seed, &c., because too often there is a bad season, and they, falling in debt to the factory they have agreed to cultivate their land for, have to continue season after season working for the planter until the debt is paid, too often only adding to it, instead of reducing it.

An indigo factory is not a very expensive investment. Vats are necessary for steeping the plant, boiling and drying houses, and a house for the planter. The cost of a factory capable of yielding an out-turn of 12,500 lbs. of indigo, worth on the spot about £2,500, is only estimated by McCulloch at an original cost of £1,500 to set up. An indigo planter's profits are in some seasons greater than those afforded by any other investment. The reason why it is such a good crop to raise in India is chiefly because of the cheapness of both land and labour. It requires a fresh, rich, and moist soil, and on such good land one acre with good management can be made to yield about 500 lbs. of indigo annually, care being taken not to impoverish the soil by allowing the roots of one crop to remain too long in it. To ensure such results science must be brought to bear, however, in the preparation of the indigo to keep it of good quality; and even yet the chemical changes and

nditions in the constitution of the plant do not appear be thoroughly understood. This is clearly demonstrated by the increase obtained in Jessore, Purneah, ishnaghur, and some other places, where the recently tented invention of Mons. P. J. Michea has been troduced with marked success into the factories, creasing the yield, in some instances, to the extent of) or 40 per cent., and showing how much waste nere has been going on. Mr. Inglis, in a work he has cently written on indigo planting, called "Sport ıd Work on the Nepaul Frontier," says he firmly lieves—"That with an intelligent application of the inciples of chemistry and agricultural science, not ıly to the manufacture, but to the growth, cultivaon, nature of the soil, application of manures, and her such departments of the business, quite a revoluon will set in, and a new era in the history of this eat industry will be inaugurated; less area for crops ill be required, working expenses will be reduced, a reater out-turn and a more certain crop secured, and l classes, planter and ryot alike, [illegible]

The chief features of the patent [illegible] it are—

"1. The employment of a [illegible] stimulate and increase the [illegible] tion of the indigo plant [illegible] colouring principle [illegible] per cent. more of indigo is obtained [illegible] plant by this process.

"2. [illegible] with the plant in the fermenting [illegible] they have been run off [illegible] beating vat, by which an additional quantity of liquor and indigo is obtained, amounting [illegible] per cent.

"3. The use of a small quantity of a neutral alum salt, to aid and facilitate the settlement of indigo in the beating vats after they are beaten off, thus saving from 8 to 12 per cent. of indigo which now runs off in waste liquor.

"4. The employment of steam to heat the water in the "*mooree*" to the required temperature when weather is unfavourable; which renders planters not only independent of the weather, but enables them to manufacture their crop at leisure though it should bring them into November"

It is claimed for the above processes that neither the colour nor the quality of the indigo is impaired, while the total extra percentage gained over the old method is very considerable.

The dye or colouring matter is extracted from the leaves by fermentation, as is generally known, which is carried on in the steeping vats before mentioned. These vats vary in size, and are placed on different levels. The green plant is packed into the highest vats, and pressed down with bamboo battens, these being kept in position by horizontal beams working in upright posts, with holes at intervals of six inches. By their means the pressure on the plants is regulated, iron pins fitting into these holes and keeping the beams down. The vats are then filled with water, and the plants left steeping from ten to fourteen hours. The water has at first a greenish yellow tinge, which gradually deepens to a greenish blue. When the steeping is over the coloured matter is allowed to run out into the beating vats, parallel to the others, but on a lower level. On the proper time the plants are steeping depends very much the quality of the dye. If the plants are very ripe when deposited in the vats, they will be ready sooner than if they are unripe, or very young.

Beating is now frequently done by machinery, but formerly only coolies were employed to beat, the process then taking about three hours. "A chemical as well as mechanical process goes on during the beating:—Chemical, oxygenation turning the colouring matter from yellow to deep blue; mechanical, a separation of the particles of dye from the water in which they are held in solution." This the beating does by causing the dye to granulate in larger particles. After the beating the dye, or "*mall*," settles at the bottom of the vat and the waste liquor is let off. This "*mall*" is then collected into the "*mall-tank*," and pumped from thence into the straining room, to be passed through wire gauze and cloth to free it from all impurities. It is then run into iron boilers to undergo the boiling process, which lasts two or three hours, after which it is run along narrow channels to the straining table, which is an oblong, shallow, wooden frame in the shape of a trough, but composed of open wood-work. It is covered with a large straining sheet, and on this the *mall* settles, while the waste water trickles through and is carried away by a drain. The dye is left on this table all night, being lifted up the next morning with scoops and put into the presses—square boxes of iron or wood with perforated sides and bottoms. These boxes are lined with press clothes, and when filled the cloths are carefully folded over the "*mall*," which is then of the consistency of starch. A heavy beam, worked on two upright three-inch screws, is let down on the lid of the press, a long lever is put on the screws, and the nut worked slowly round. The pressure is enormous, and all the water remaining in the "*mall*" is pressed through the cloth and perforations in the press-box till nothing but the pure indigo remains behind. The presses are opened and a square slab of moist dark indigo, about

three or three and a-half inches thick, is carried off on the bottom of the press to the cutting frame, where it is cut into bars; the bars again divided into cubical cakes, which are each stamped with the factory mark and number and noted down in the books. These cakes are then taken to the drying-house. This drying process takes three months, the cakes being frequently turned during this time until they are quite ready for packing. They are placed in order of quality, the finest being packed first in mango-wood boxes, which are first weighed empty and then reweighed full, the difference giving the net weight of the indigo. The tare, gross and net weights are legibly printed on the chests, also the factory mark and number of the chest; and when all are ready they are sent down to the Calcutta brokers for sale.

Besides the indigo grown for manufacture, there is another branch of the industry carried on in North Bhangulpore. This is the growing of indigo-seed to supply the Bengal planters. The mode of cultivation differs little from that pursued in the ordinary indigo growing; the seed being sown in June, carefully weeded and tended through the rains and cut in December. This seed-growing is carried on by the ryots under the advance system, the cultivator getting about 4 rupees per maund of 80lbs. (avoirdupois).

Up to the year 1783 the indigo industry did not command much attention, but since that time it has increased—with the exception of a few bad years, notably that of 1842—with steadiness. In 1866 the value of the Indian exports was £1,186,501; and the following table will show how exports of the article have stood during the last five years:—

Years.	Cwts.	Rupees.
1873–4	115,930	3,55,52,967
1874–5	81,466	2,37,03,022
1875–6	110,392	2,87,50,025
1876–7	100,384	2,96,27,856
1877–8	120,916	3,49,43,340

France took about a fourth of the total exports during the last official year, during which, as will be seen, 20,000 cwts. more were exported than during the previous year, and this was a considerable increase on the indigo she had imported in the past years. In fact, while the quantities sent direct to foreign countries are increasing year by year, those to the United Kingdom are in a measure falling off. It is probable, however, that the improvements the new patent will affect in the quantity and quality of East Indian indigo will increase our importation of it. The general depression in all trade circles has probably affected this article of commerce with us in the same way as other industries have suffered.

LAC.

This substance is also called gum-lac, but erroneously, for in reality it is not a gum, it being produced on certain trees by an insect, the *coccus ficus*, which deposits its eggs on the branches and leaves of the trees it affects, and then covers them with a reddish resinous substance—the lac of commerce. This peculiar exudation is evidently intended as a protection to the egg and maggot which is hatched from it, it may also serve as food for the maggots while in their first stage. The lac is arranged neatly in cells, differing only in form from a honeycomb, and the colour obtained from it when collected is

very valuable, as it is a beautiful scarlet, which is more permanent than that yielded by the true Mexican cochineal, though of not quite such a fine colour.

In commerce three kinds of lac are known—stick-lac, seed-lac, and shell-lac.

Stick-lac is lac in its natural state, the branches and twigs encrusted with this substance being broken off and collected twice a year The best is of a deep red colour, when collected for export it is separated from the branches, to lessen the expenses of freight, the wood to which it is stuck being so bulky an article to ship. It is usually gathered before the insects have worked their way out of their cells, because if left until they have liberated themselves the dye is nearly spoilt, or at least is of such a much paler colour that as a colouring matter it is nearly useless, though in that state it answers equally well for varnish. The dye which is extracted from stick-lac is called lac-dye, also lac-lake or cake-lac, because it is usually formed in little square cakes. Good cake-lac should be smooth, shining, and dark coloured, when powdered or scraped it should be of a bright-red; if it is a dull muddy red, or brick dust colour, it is inferior and should not be purchased.

The native dyers pound the lac when they have removed it from the branches on which it is found, and extract as much of the colouring matter as they can in water. After this process a yellowish hard powder remains; this is the *seed-lac*. Fire is brought to bear on this powder, which liquefies it, and it is then made into cakes, and called lump-lac; this the natives use in the manufacture of the common bangles worn by Indian women. *Shell-lac* is made from seed-lac in this manner. The seed-lac is collected in bags and held over charcoal fires. The lac when melted strains through the bags and is saved, the lique-

fied matter being formed into thin plates of a yellowish brown colour and is termed "shell-lac."

Lac-dye and lac-lake are made in India, where they are eagerly used in scarlet dyeing; they are manufactured from stick-lac and are prepared by dissolving it in an alkali, such as potash or soda, a solution of alum is then added, and by this a mixture of the alumina of the alum and the resinous and colouring matter of the stick-lac is precipitated. The lac-dye is considered the most valuable of the two preparations. Shellac is chiefly used by hatters, sealing-wax makers, and varnish makers, it being one of the chief ingredients in very many varnishes.

Formerly very heavy duties were charged on all lacs entered for consumption,—on lac-dye, seed-lac and stick-lac 5 per cent. was the duty levied, while shell-lac was charged 20 per cent. This appears to have been a very extraordinary proceeding, especially when it is considered that it is, as I have already stated, made from the refuse of seed-lac. In 1866 the duties on lac were [illegible]. [illegible] some sorts of lac, such as [illegible] and [illegible], are [illegible] with a duty of 4 per cent.

In India the trees which the [illegible] chiefly on which it deposits its eggs and [illegible] ing matter are the [illegible] the *Ficus Indica*, *F. religiosa*, the [illegible], the *Butea frondosa* [illegible], and the *Zizyphus jujuba*, besides others which [illegible] Siam, Assam, and Pegu.

With regard to the trade in [illegible] depressed state, especially [illegible] doubt the most important [illegible]. The following are the figures for the [illegible] years.

Years.	Cwts.	Rupees.
1873–74	65,769	18,41,490
1874–75	67,705	18,95,637
1875–76	80,645	65,06,928
1876–77	89,879	42,20,497
1877–78	78,875	28,50,552

The total quantity and value of all the different forms of lac for the last five years are as follows:—

Years.	Cwts.	Rupees.
1873–74	75,798	25,76,527
1874–75	76,643	25,40,112
1875–76	103,583	75,57,474
1876–77	128,712	53,69,764
1877–78	104,645	36,20,481

The fall in prices has been caused by excessive stocks. The prices for lac-dye vary from 6d. to 2s. per lb., and for shell-lac (orange) from 120s. to 145s. per cwt. There are distinguishing marks by which the different sorts of lac are judged. The finest is marked D.I., the second sort T.D., and the third J. McR., C.E., and so on.

MADDER.

Madder holds a high place amongst plants yielding a red dye. It is indigenous in the Levant, Italy, Switzerland, and in the Southern portions of France. Many attempts have been made to grow it in England, but with little success; being an expensive crop to grow, it is found that it can be imported at less cost than it can be raised for. Taking into consideration the rent and expenses of three years, the labour and excessive

attention the plant requires during its growth, and the time it occupies the ground before giving any return for the outlay, it is not difficult to understand that English farmers decline to have much to do with madder, especially as it can be obtained from so many different sources. The Indian madder is slightly different to the European, though in all leading properties it is virtually the same. It does not, however, command so good a price as European madder; that coming from Smyrna is the most esteemed of any imported.

The *Hedyotis umbellata*, or Indian madder, and the *Rubia cordifolia*, sometimes named *Rubia munjista*, known in commerce as munjeet, are the two kinds imported from India. The first mentioned—which is known in Europe as chay-root—is a smaller plant than the European *Rubia tinctoria*. It is indigenous on the Coromandel coast, and is largely cultivated in the districts of Rajahmundry, Guntoor, Masulipatam, also in Nellore, Tanjore, and South Arcot. The roots of this plant give the most durable [illegible] an orange brown dye. It has [illegible] fine sandy soil is required for the [illegible] and proper growth of chay-root, as [illegible] spread and general growth of the [illegible].

In the jury reports of the Madras Exhibition considerable information on the subject [illegible] be found, also on the [illegible] which of late years have [illegible] chay-root dye, and have [illegible] its use, though not [illegible] of colour and durability [illegible] growth and produce of *Hedyotis umbellata* [illegible] of May the cultivation commences [illegible] the land is repeatedly ploughed [illegible] cleaned. It is [illegible]

after the final ploughing is levelled and formed into beds about six feet by three. Then the seed, which is so minute that it cannot be gathered, but has to be swept up at the end of the harvest with the fine surface sand into which it has fallen, is sown, a thin layer of the fine sand containing it being spread over the prepared beds. These are kept moist, being watered through a fine sieve five or six times a day. In fourteen days' time the seeds will have germinated, and after the seedlings have appeared they are only watered once a day with water, and sprinkled once with liquid manure. In two months the plants will have reached their full height, but the beds will be filled with weeds, which have to be very carefully removed. At the end of six months from the time of sowing, provided the season has been a fairly good one, and the usual rains have fallen, the plants will be fully matured and the roots be ready to dig up. In an ordinary season the yield of a plot—or, as the natives call it *poda*—of an acre and three quarters, will be about eight candies of 500 lbs. each.

In digging up the plants a light wooden spade tipped with iron is used. The stalks are not cut off, the whole stems and roots being tied together in handfuls. In this state they are left to dry. After the leaves wither and fall off, the bundles are weighed and removed. The seeds are shed before the plants are taken out of the ground, and get so mixed up in the sandy soil, being so very small, that they cannot be separated from it, so the surface is scraped, and seeds and sand preserved together for the next year's sowing.

In the Appendix before mentioned the following table of expenses of cultivating a plot of ground is given :—

Ploughing	5 Rs.
Manuring	5
Clearing, smoothing, etc.	2
Watering	6
N.B.—If the rains are seasonable this is proportionately reduced.	
Weeding	6
Digging at so much the candy, generally about	36
	60 Rs.
Add the land-tax at 14 Rs. the acre	25
	85 Rs.

Assuming the produce to be eight candies, and the average price 16rs. per candy $8 \times 16 = 128 - 85 = 43$rs. for the cultivator's profit, which cannot be considered large compared with the constant care and attention required to secure a good crop.

The assessment on such land as yields chay-root has been very much reduced, however, and now does not exceed three rupees per acre, while the average price, which has been considered at only 16rs., when the demand for the root is great, rises often to 25rs. There are no returns of the out-turn from the spontaneous chay-root, the right of collecting it is farmed out, in Masulipatam the amount of 335rs. only was bid for it; but in Guntoor it fetches a much higher price, the rent selling for as much as 7,450rs. The same land can only be worked every third year for spontaneous produce. The greater portion of the root is used on the spot and in the village of Velapalem, where weaving is largely carried on. Some 22 candies were exported once to Tranquebar, but the great portion is used up in the town of Bunder for chintz printing and dyeing cotton cloths.

The introduction of *Cherinji*, the bark of a root grown in the Deccan, has lessened the trade at Masulipatam, as, though the dye obtained from it is neither so brilliant nor so durable as that from chay-root, it is not such an expensive crop to grow, and when mixed with a leaf called jagi produces a very fair colour, though a more fugitive one. Eventually it must drive the trade in chay-root out of the market, because it is a much cheaper dye, and not only less expensive, but procured by a far less tedious and complicated process. Such colours as those for which the red turbans of Madura are famous will, however, never be obtained from cherinji, as a drop of spirit even which falls on a cherinji-dyed material will take out all its colour at once, whereas it has no effect on cotton dyed by chay-root. In Ceylon chay-root forms a considerable article of export, only a particular set of people are allowed to dig it, and at one time it was all bought up by Government, who gave the diggers a fixed price of 75 or 80 rix-dollars a candy; it being sold for exportation at about 175 rix-dollars.

Though imported into Europe, it has never been looked on very favourably. It is deteriorated by a long sea voyage, and being a bulky article the freight charges are very heavy, which materially raises its price in the home-market.

The *Rubia cordifolia*, or Munjeet to call it by its best known name, is chiefly produced in Bombay and Scinde. It is even more closely allied to the ordinary madder than the chay-root, producing quite as brilliant a colour, which has the credit of being even more durable. Its roots are in great demand amongst the dyers of Southern India, as with the use of proper mordants its brilliancy of hue and permanency as a fixed colour are only equalled by the *Rubia tinctoria*. The exportations have, however, fallen off since 1835,

when the average for that and the four preceding years was 28,826 bales, the price per cwt. in the London markets being for the best 34s. The amount imported in the United Kingdom is much less, being for 1866 only 1,850 cwt. and for 1867 only 380 cwt., valued at £504.

With European and Indian madders the roots of the plants are the only portions which yield the dye. The leaves are in some cases used medicinally, being given in asthmatic complaints and consumption.

The three different colouring matters contained in the roots are *alizarin*, *purpurin*, and *xanthin*, the two former being red, and the latter yellow.

The various preliminary processes to which the roots are subjected are picking, drying, freeing from earth and epidermis, and powdering. This powder is called *garancine*. The finest is produced from the roots, which have been cleaned and stripped of their bark; the "second," from the roots, which are ground without being cleaned; and the "third," by mixing the bark of the first while grinding.

Besides the three colouring principles [illegible] madder contains lignin, resin, gum, sugar, [illegible] vegetable acid, a bitter substance, and a [illegible] animal matter.

[illegible]

The *Kamala* dye, which is obtained from [illegible] tree, is not nearly so much known [illegible] be in this country, though in India [illegible] used by native dyers [illegible]

The colouring matter is contained in the [illegible] powder with which the capsules are covered. [illegible] powder is of a rich red colour.

The capsules are [illegible] covered with this red powder. [illegible]

collecting it is in February and March, when the capsules are quite ripe, it is simply brushed off them, and is then ready for sale, needing literally no preparation. This powder is hardly acted on by water, neither alkaline solutions nor spirit dissolving it, though to the latter it gives a deep reddish orange tint. Alum has only the effect on it of deepening the colour, and making it more bright and permanent. Native silk dyers dye with it in this manner:—They take "four parts of powder, one of powdered alum, two of salts of soda, rubbed well together with a small quantity of oil of sesamum. When well mixed it is boiled in water proportionate to the silk to be dyed, and kept boiling smartly, according to the shade required, turning the silk frequently to render the colour uniform." It gives a fine yellow colour, or orange tint of great beauty and extreme stability. The jurors at the Madras Exhibition reported very favourably on it, and it is stated that the tree is widely spread over the Madras Presidency, and therefore the supplies to be obtained of this dye might be, comparatively speaking, considered as unlimited. It contains between 70 and 80 per cent. of real colouring matter, and requires no mordant, only having to be mixed with water containing about half its weight of carbonate of soda, to be fit for use. Dr. Roxburgh, Dr. Hanbury, Dr. Royle, and Anderson have all spoken both as to its dyeing and medicinal properties; and it might certainly be introduced by dyers in other countries with advantage to them, as well as made a source of wealth to its native land.

MYRABOLAMS.

The trade in valonia and galls from Turkey has been considerably interrupted by the recent war, and the

lessening of the importations from that country has had much to do with the increase in the Indian myrabolam exports into England and France.

This dried fruit of the *Terminalia chebula* is used by the Indian natives very largely as a substitute for galls, as it is found to possess all the properties which distinguish them. *Terminalia* (derived from *terminus*) is the name of the genus of plants belonging to the natural order Combretaceae, of which there are many species. They consist of trees or shrubs with alternate leaves; flowers destitute of petals disposed in spikes, containing in their lower portion stamens and pistils, but in their upper part only stamens, these are ten in number, arranged in two series, being longer than the calyx; the fruit is drupaceous and has only one seed.

The best known of the species are *T. chebula*, *T. angustifolia*, *T. bellerica*, *T.* [illegible], *T.* [illegible], and *T. catappa*. It is the first of these which is under consideration. *T. chebula* is a valuable tree growing from forty to [illegible] feet in [illegible] and is prized not only for its fruit—the [illegible] of commerce—but also for its timber, which is [illegible] used in building and for agricultural purposes. [illegible] thirty years old it is said to have [illegible] size. Its leaves are opposite and [illegible] beneath. Spikes are terminal, [illegible] rous; flowers small, white, and [illegible] faint odour. The fruit, which is a [illegible] lar nut, varying in size from that of a [illegible] a gall nut, is covered with a [illegible] the valuable portion of the fruit [illegible] ous and very astringent, when fresh of a [illegible] colour, which with age deepens into a [illegible] and when dried becomes nearly black. [illegible] coat of the nut mixed with sulphate of iron [illegible]

good and durable ink; it is also much used by tanners and dyers, as mixed with weaker solutions of sulphate of iron it makes a fine brown colour; if combined with alum the result is a buff colour, which the chintz printers use largely; and when mixed with iron filings and water, it dyes leather a good black, producing on it precisely the same effect the use of galls would.

This tree is subject to galls also from the attacks of insects, and these when found are much valued for their astringent qualities, being reckoned by the natives a most efficacious remedy in diarrhœa, more particularly in infantile cases. In India myrabolams have long been employed as a dye in calico printing, and in medicine. The unripe dried fruit acts as a purgative when administered internally, and applied externally is found useful in skin diseases. The trade in this article for the last three years was as follows:—

Year.	Cwts.	Rupees.
1875–76	286,350	10,64,013
1876–77	361,217	13,58,225
1877–78	537,055	23,05,265

The increase in 1877-78 over the two preceding years is very considerable, and as there is a railway about to be laid between Nagpore and Chhattisgarh the trade —when it is ready for traffic—in myrabolams will undoubtedly increase, for it will open up forests which abound in *T. chebula* trees; the greater facilities of carriage then afforded will develope this industry, for the supply of myrabolams to be obtained from the tracts through which the line will run will be almost inexhaustible; these forests are at present inaccessible, but when they are laid under contribution their pro-

phate of copper, crimson; and on sulphate of iron a deep violet.

We do not import so much of this wood now as formerly; in 1867 1,191 tons were imported, the value being £5,870. The wood is shipped in large billets. It has fallen in value considerably within the last ten or fifteen years, being at one time quoted at from £18 to £20 per ton.

Red saunders is used also in medicine, and the Arabs have been aware of its value as a drug from very early times, it being known to them under the name of *sundroos*. The natives in India powder the wood, and mix it with oil, in which state it is used for bathing and cleansing the skin, they also administer it internally in milk in cases of hæmorrhage, and when beaten into a paste they anoint the eyes of those suffering from ophthalmic disease.

It is mostly exported from Madras, the billets of wood being brought in by the natives in large quantities from the hills near Pulicat. The *Pterocarpus santalinus* also exudes a reddish-coloured juice, which hardens into a sort of astringent gum, a species of "dragon's blood," and the other species many of them have exudations of a resinous nature, particularly *P. marsupium*, which grows in the Circar Mountains. The dark red-coloured gum obtained from it is the *kinos* of commerce. The *P. crinaceus* is, however, supposed to yield the real *kino*. It grows on the west coast of Africa.

SAPPAN-WOOD.

This wood also contains a valuable dyeing substance. The *Cæsalpinia sappan*, commonly called sappan-wood, is a thorny natured tree, growing in the South of India, in Siam, and in Pegu. It grows

from 30 to 40 feet in height, has oval emarginate leaves of a pale colour on the underside, the flowers are yellow and have ten stamina. The colouring matter obtained from the wood differs very little from that obtained from Brazil wood, only the same quantity of sappan-wood does not yield nearly so much colouring matter as an equal portion of Brazil wood. The price, therefore, the latter commands is greater, selling sometimes for as much as £30 per ton, while sappan-wood at the highest reaches but £15 per ton. In 1867 the imports of sappan-wood were 1,489 tons, valued at £14,843, or a little more than £9 per ton; in 1870-71 the exports of the wood from Bombay are stated in the report of the Madras Exhibition to have been 1,085 cwts., valued at 4,194 rupees.

In India the natives have been acquainted with the dyeing properties of sappan-wood from the very earliest times. It is one of the chief ingredients in their celebrated chay-dye. The wood contains so much gallic and tannic acid that they also use it as a substitude for logwood. Ceylon exports annually a great deal of sappan-wood, but the finest specimens are to be found in Malabar and Mergui: the chief London shipments are from Calcutta. A very curious custom prevails amongst the natives of Malabar. So much do they value sappan-trees, that when a daughter is born to them, at her birth they plant from 40 to 50 seeds of the sappan. The trees reach maturity in about 12 years, and are then reckoned as the daughter's dowry when she is married. The Persians used the sappan-wood in medicine, pulverised of course, writing of it as *bookum*, the word being evidently derived from the Hindi name *bakkum*.

SAFFLOWER.

Safflower, or Bastard saffron, is the flower of the *Carthamus tinctorius* (Linn.). The trade in these flowers was once very valuable to India, more so than it has been for the last two or three years, as lately the coal tar colours are driving the dye made from safflower out of the field and reducing their value as one of the Indian exports. It still, however, holds its place with the natives as a brilliant though evanescent dye, and as they use it largely for home use, it must still rank among the industries of the country, as many people are employed in its cultivation and preparation. They express an oil also from the seeds, which contain a large percentage of oil, and use it in their lamps as well as for cooking purposes. The seeds themselves are given as an aperient, also in cases of dropsy and jaundice. It is for a dye, though, that the *Carthamus tinctorius* is chiefly grown.

The plant is an annual, growing from one to three feet in height, having an upright, firm, smooth, almost white stem, divided at the top into branches. Its leaves are oval in form and spiny. The branches are terminated by large flower-heads, composed of several flowerets, which are all furnished with stamina and pistils. The flowers are deep red in colour.

This plant is propagated by seeds, which are generally sown in February, in drills about two feet apart. They germinate in about a month. After the young plants appear they are left for another month untouched, but after this time has elapsed they undergo their first hoeing, are well weeded, and considerably thinned out, six or eight inches being allowed between the rows. Before they come into blossom they go through a second and third hoeing

and weeding. ... than they do ... smaller and do ... matter is ... course ... soil which is ... the safflower ... well manured.

The flowers ... are gathered ... open ... if they are ... fades, and their ... care is necessary ... flowers ... badly ... they are gathered ... place.

Safflower ...

still farther to promote the solution of the yellow colouring matter, a man in the trough treads the sack and subjects every part to the action of the water. When this flows without receiving any yellow tinge in its passage the washing is discontinued, and the safflower, if not wanted for immediate use, is made into cakes, which are known in commerce under the name of stripped safflower."

To prepare these cakes for use when wanted, they should be steeped all night in water, and rubbed out in the morning until they are thoroughly broken up. Then the safflower is enclosed in a bag and held under a good stream of water, until it is freed from all impurities. A tub is prepared holding from twenty to thirty gallons in which half-a-pound of soda has been dissolved. In this tub the safflower is placed and allowed to bleed for about an hour; then strained through the bag into a second tub. It is refined by having cotton yarn or cloth immersed in it, which is lifted every ten minutes and tartar added. This is done three times. Then it is washed in three waters, then bled again in a tub of clean water and soda, and this liquid is then ready to mix with the proper quantity of water for dyeing. It is chiefly used in dyeing silk, the colours it produces varying with the different alteratives with which it is combined. Alum, tartar, sulphuric acid, and potash are all used in preparing safflower for dyeing. The resinous part is preserved by simply drying the precipitate, and when left in this state it is called India or China lake. It is this precipitate when mixed with finely pulverized talc which is known by the name of *rouge végétale*. The Chinese call this colour *bing*; and Thunberg says, in his "Travels in Japan," that the Japanese ladies use it as a cosmetic, keeping it in tiny round porcelain cups, and painting not their cheeks with it,

as Europeans do; but their lips. The finest and [illegible] safflower commanding the highest price comes [illegible] China, and is considered superior to the Indian [illegible]. It is cultivated in many parts of Europe, in [illegible] and very generally found in India, particularly [illegible] pootana, Assam, Dacca, and Bombay, though [illegible] coming from the last-named place is but little thought of.

The average annual importations into the United Kingdom for the five years [illegible] in 1833 were [illegible] bales, each weighing one [illegible] the average price during that time was abo[illegible] per cwt. In [illegible] McCulloch informs us [illegible] cwts. of safflower were imported into the [illegible]gdom, valued at £54,469, of which 6,956 cwts. were re-exported. The duty of 1s. per cwt. w[illegible]merly charged on the importation of this artic[illegible] this duty was repealed in 1845.

Of late years there have been no official returns of safflowers imported; but the trade in them has, as I have before remarked, [illegible] Indian export trade, and [illegible] will [illegible] long entirely supersede the use of safflower, [illegible] the *rouge* preparation made from them will [illegible] continue, as for this particular purpose [illegible], though used, are not found to answer [illegible] as well as the vegetable substance made from [illegible].

TURMERIC.

Turmeric is obtained from the root of the *Curcuma longa*, which belongs to the natural order *Zingiberaceæ*. It is an [illegible] plant, with long [illegible] succulent roots, spreading far under the surface of the soil. These roots are divided into numerous [illegible], having circular knots or joints. From these [illegible]

four or five leaves, which are about a foot in length, broad, lanceolate, and sheathe each other at the base. From their centre spring the loose, scaly, leafy spikes of flowers, in colour creamy white, or yellowish red. The roots are hard, and are said by many to bear both in size and shape a striking likeness to ginger. The best roots are the large new and resinous ones, which are hard and difficult to break.

Curcuma longa is indigenous in India, being found wild in many parts. It grows also in China, Java, and Sumatra, and has been cultivated with some success in Tobago. The natives esteem it very highly for its medicinal properties, though in Europe these are now held in slight estimation, turmeric being chiefly imported for the sake of the dye to be extracted from it. In India it is used as an ointment in skin disease and foul ulcers, as an application for fresh wounds, bites, and bruises, and as a cordial and astringent medicine in diarrhœa. The natives also use it in the preparation of their far-famed curries, to tinge the rice used in them yellow. Curry-powder contains a considerable portion of turmeric, in fact it forms one of its chief ingredients.

The roots are externally of a greyish colour, but internally they are of a deep rich yellow. Before being used for dyeing purposes, the roots are ground down to powder. Turmeric yields a wonderfully bright yellow colour; but the unfortunate property it has of being very evanescent, deteriorates much from its commercial value, for, rich though the colour be, it is almost impossible to fix it, as on exposure to air it fades away. Chloride of sodium, and muriate of ammonia, are most efficacious in fixing the colour, but they destroy in great measure the richness of the yellow, turning it almost to brown. It is used as an ingredient in yellow varnishes, and is employed at

times to colour culinary preparations as a substitute for saffron.

The starchy portions of the young roots or tubers form one of the Indian arrowroots; and Lindley has observed that the same tubers which when young yield starch, when old yield turmeric. He also says that the juice is a test for free alkalies. Roxburgh gives this account of its cultivation:—"The ground must be rich, friable, and so high as not to be drowned in the rainy seasons, such as the Bengalees about Calcutta call Danga. It is often planted on land where sugar-cane grew the preceding year, and is deemed a meliorating crop. The soil must be well ploughed and cleared of weeds. It is raised in April and May, according as the rains begin to fall, into ridges nine or ten inches high and from eighteen to twenty broad, with intervening trenches nine or ten inches broad. The cuttings or sets, viz., small portions of the fresh root, are planted on the tops of the ridges at about eighteen or twenty-four inches asunder. One acre requires about nine hundred weight, and yields in December or January about two thousand pounds weight of fresh root."[*]

The natives have of late years paid much greater attention to the growth and cultivation of the Curcuma longa, finding that there is a demand for it in the London market, and that it pays them to grow it in larger quantities for exportation; it is now very generally cultivated all over India.

There were formerly duties on turmeric, but in [illegible] these were reduced, and in [illegible] wholly repealed. The imports of the article increased very much after the duty was finally taken off, and each year India exports more, the chief portion coming to the United Kingdom, much of it being re-exported. In [illegible] the imports were 1,541 tons, valued at [illegible], the [illegible]

price of turmeric then in London varying from £18 3s. to £22 7s. per ton, Bengal turmeric fetching the best price. Now the imports have risen to 147,227 cwts. in 1878 as against 123,820 cwts. in the preceding year, the price it now fetches in the London market being £11 3s. per cwt. for Bengal, and from £15 to £25 for Madras finger.

RED DYES.

Adenanthera pavonina, red.
Basella rubra, Malabar nightshade, rich purple, but difficult to fix.
Canna Indica (Linn.), purple.
Grislea tomentosa (Roxburgh), red.
Memecyton tinctorium, red.
Morinda citrifolia (Linn.), scarlet.
Rubia cordifolia (Linn.), red.
Symplocos racemosa (Roxburgh), red.

YELLOW DYES.

Berberis tinctoria, dyers' berberry, yellow.
Butea frondosa (Roxburgh), bastard teak, yellow.
Butea superba (Roxburgh), yellow.
Cassia auriculata (Linn.), yellow.
Coxinium fenestratum, buff.
Morinda umbellata (Linn.), yellow.
Nyctanthes arbor tristis (Linn.), orange.
Pterocarpus marsupium (Roxburgh), yellow.
Trapa bispinosa (Roxburgh), yellow.
Wrightia tomentosa, yellow.

BROWN AND BLACK.

Acacia Arabica, babool, brown dye.
Artocarpus hirsutus, brown.
Casuarina muricata, brown.
Seymida febrifuga, brown.
Syzygium jambolanum, brown.
Terminalia tomentosa, black.

CHAPTER XII.

FIBROUS SUBSTANCES.

COIR.

This fibrous substance is produced from cocoanuts, being contained in the husk in which the nut is enveloped. It is obtained by fixing a sharp iron or wooden spike into the ground, the nut is struck on its point and the fibres easily stripped off. A man can clear the husks from about 1,000 nuts in the course of a day. Formerly the rind of the cocoanuts was soaked in water, sometimes for more than a year, before it was beaten out; but this lengthy process has now been found to be quite unnecessary. It is simply washed, soaked, beaten and rubbed out with the hand, these different processes taking a comparatively short time compared to the older method.

The fibres are difficult to twist, but well repay the trouble taken with them; for *coir* when properly prepared is one of the very best materials for cables, on account of its wonderful strength and elasticity. It is, therefore, well adapted for cordage of all sizes, and very largely used; until chain cables were introduced, all the ships navigating the Indian Seas were furnished with cables made of this material, sea-water having no deteriorating action upon the fibre.

Large quantities of [illegible] are [illegible] and the exports have increased [illegible] last fifteen or twenty years. In [illegible] value £21,844 were exported [illegible] 1860-61 the quantity had risen [illegible] at £57,284; in 1866, [illegible] valued at £13,309: [illegible] the Indian coir exportation [illegible] ing have been the quantities [illegible] five years:—

Year.	[illegible]	
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

In the years [illegible] included in the figures [illegible] years. The prices [illegible] are:—

[illegible]

FLAX.

As stated in the remarks on linseed oil, flax is cultivated in India far more on account of the oil expressed from its seeds than for its fibrous properties, but in every other country where it is raised its fibres are woven into cloth.

The foreign supply for the United Kingdom is imported from Russia, Prussia, Hamburg, Holland, Belgium, France, Italy, and Egypt; Russia supplying by far the greater portion. Though for centuries flax (*Linum usitatissimum*, Linn.) has been largely grown in India, it is only quite recently that attention has been drawn to its valuable fibrous qualities; the oil only being considered worth exporting, the stalks were thrown away as useless, and so much excellent fibrous matter has been entirely wasted. It is to be hoped that the experiments of cultivating flax in India for the sake of its fibre may meet with success, and encouragement be given to those ryots who have been persuaded to grow it for this purpose, and to European cultivators who have engaged in this industry.

In the ordinary course of growing flax in India for the seeds alone it is generally mixed with other crops, mustard being usually grown with it. Such a system would never answer if it is grown for fibre; and here at the outset considerable difficulties have to be overcome. The ryots have been used to mix it with other crops, and use being to them second nature they will, unless very strictly looked after, continue in sowing to mix the seed.

Dr. Roxburgh, whose interests have always been exercised on India's behalf, was the first to attempt flax cultivation in India; he started an experimental

farm near Calcutta, in the early part of this cent[illegible] Since then improvements have been made in [illegible] growing for fibre; and the idea has spread. So far it has best succeeded in Burdwan and Jubbulpore, and in the territories of Saugor and Nerbudda. Dr. Jamieson gives a report of its cultivation in the Punjâb, which appears to have been successful; the fibres being pronounced by competent judges as equal to the best Russian flax. When one considers how much land, not only in the Punjâb, but all over India, is available for the growth of this valuable commercial article, it seems extraordinary that it should not be more largely cultivated, not only for use in the country, but also for exportation. It is a matter for much surprise, too, that considering the great antiquity of the cultivation of flax for clothing purposes, that the Hindoos, so famous for their weaving and spinning, should not have discovered for themselves the great commercial importance of flax. This plant is among those mentioned very early in the Scriptures and very frequently; it being first named in the account of the Egyptian plagues, when "the flax and the barley was smitten" by the grievous hail. That the Egyptians were well acquainted with the uses of the plant as a weaving material we gather from Isaiah xix. 9, where later the Egyptians are threatened, and the ruin of their crops is foretold, when it is also shown that "they that work in fine flax, and they that weave net- (white) works, shall be confounded." [illegible] prior to it frequent mention is made of [illegible] and we gather from Proverbs that women in particular worked with it: "She seeketh wool and flax, and worketh willingly with her hands. [illegible] her hands to the spindle, and her hands hold the distaff." Many other mentions might be [illegible]

but the early use of flax is such a well-known fact that to multiply them is unnecessary.

Fresh rich land is the most desirable for growing the plant. After two or three ploughings it is rolled, and the earth thoroughly pulverized before the seed is sown. Manure should be given, as the quality of the fibre is much improved by such treatment; but, unfortunately for Indian agriculture, manure is too rarely to be obtained. The seed is generally sown during October and November, and is pulled up (for fibre) by the roots before it is ripe, and while the bark is fusible. A day after the stems have been pulled they are steeped, which process is conducted in the same way as with hemp, or jute. When taken out of the water, which must be done very carefully, it is allowed to drain for some hours, and then spread out to dry; when completely dried, it is ready to dress.

Flax is easily grown, but its quality depends very much on the fitness of the soil for such a crop—which is a very exhaustive one—on the proper time of pulling the stalks; on the length of time the bundles of stems are immersed in the water; on the care taken in removing them from the pits, draining and drying them, and so on.

Good flax should be bright in colour, well separated from tow, and coarser portions of the plant, and the fibres should be long, strong, and fine. Dutch flax is generally well dressed and of good quality, and the "Riga" is the best of any imported from the Baltic, the prices varying according to the quality, which is determined by various marks known in the trade. The best Russian flax is quoted at Archangel £53 to £54 per ton, Zabrac from £43 to £48, St. Petersburg, 12 h.d., £28 to £36, St. Petersburg, 9 h.d., £24 to £25, Egyptian government dressed £45, Egyptian common £19. Those specimens which have been forwarded from Cal-

cutta to the United Kingdom were valued at from £30 to £60 per ton, but as yet the exportations are of little note.

HEMP.

The genus of plants that yield the substance called hemp are named *cannabis*, from which Latin word our English canvas is derived. *Cannabis sativa*, common or true hemp, is a plant allied botanically to the nettle, which it resembles very closely in appearance. Roxburgh says that the *Cannabis sativa* is indigenous in India and is found in the northern parts of the country; it is also a native of Persia, Egypt, Africa, Canada, United States, and Nova Scotia, in China, Chinese Tartary, Russia, Poland, Siberia, France, Spain, Denmark, Sweden, and Italy, Great Britain and Ireland. Our growth of this valuable plant is quite inadequate to our demand for it, so our importations increase from year to year. English grown hemp bears, however, a good name, though the quantity grown hardly affects our market, so trifling is it; but when properly prepared it is [illegible]. It is grown chiefly in Suffolk—where a [illegible] is manufactured from it—in [illegible], Lincolnshire, Norfolk, and [illegible]. The English farmers do not consider it a profitable crop, [illegible] one easily grown; it requires good manuring and [illegible] best in a rich moist [illegible]. It has the property of [illegible]ing weeds, so that ground cropped with hemp is generally free from other vegetable growth [illegible] consider a sign of its being a [illegible] crop with which to sow land and [illegible] why it is not more grown in England. The [illegible] supposed to be poisonous, and the [illegible] in the soil to continue long after the hemp has been withdrawn, and thus render the land [illegible] for other kinds of crops which may be sown on it [illegible]

that as it may, the cultivation of hemp in England has certainly declined of late years. Hemp when required for cordage is generally sown in drills, when for weaving purposes it is scattered broad-cast. Three bushels of seed is the usual allowance to an acre, that is when it is sown broadcast, but when in drills half that quantity is sufficient. Birds are about the only enemies to hemp, they have to be carefully watched and driven off; the seeds adhere to the plants when they first appear above the ground and the birds are attracted by them. Caterpillars and other insects do not touch them, or, if they do, are killed by the poison contained in the leaves.

Hemp is laid in water as soon as possible after it is pulled, and after it has been well macerated it is dried, often in a kiln. When dried it is broken by mills, or in a hand-break; it is then "scutched," "beetled," and "heckled," after which is sorted and prepared for sale. The fibrous properties are contained in the channelled hollow stalk, which is filled with a white soft medullary substance enclosed in a very tender tube, composed of a cellular texture, and of fibres, the *boon* of the hemp. If the fibres of hemp are looked at through a microscope each fibre will be found to consist of a bundle of fibres of the very finest texture, these are all twisted together, but the maceration which the plant undergoes draws them out to some length.

The ordinary hemp is an annual diœcious plant, with an erect stem from four to six feet in height, covered with rigid hairs. The leaves are alternate or opposite, digitate and stalked; leaflets, five in number, are narrow and serrated. The male plant bears the flowers, and the female the fruit or seed. The male hemp comes to maturity three weeks or a month before the female. In some places the male plants are gathered first; but the more usual method is to pull

both plants together. [illegible] seed is quite ripe, as [illegible] comes woody and coarse. [illegible] in the returns of the [illegible] price than the imp[illegible] only on account of [illegible] obtained from Riga. [illegible] because of the care [illegible] into different classes, [illegible] clean," "Riga," &c.; [illegible] in a mixed state, which [illegible] commercial value. In [illegible] ports are at the rate [illegible] stands next to Russia. [illegible] ever, increased her [illegible] the *Cannabis sativa* [illegible] contained in the plant [illegible] ing properties, that [illegible] poses, the quality of [illegible] inferior, at least as far [illegible] cerned. The [illegible] a very similar nature [illegible] to mention presently.

Hemp must always [illegible] power, an article of [illegible] use in the formation of [illegible] ropes, sailcloth, canvas, [illegible] a glut in the market. [illegible] much in price, going [illegible] ton; but this was when [illegible] against us. After 18[illegible] £24 and £50 per ton, [illegible] beyond £30 per ton. [illegible] to £25 per ton is the price [illegible]

A very good huckaback [illegible] and common tablecloth. [illegible]

much used in a different way. It contains a narcotic secretion of great power. The smell from a young hemp plantation is so strong that if it is remained in any time, headache, giddiness, and sickness will be produced. The leaves, when powdered and infused in water, cause in those partaking of it a dreamy, sleepy, semi-conscious state; the effects of it on the system are said to be less deleterious than opium and more agreeable. This drug is known by various names, *bhang* or *gunjah*, *haschish*, *cherris*, *kinnab*, *subjah*, *majah*, &c. Those who have been in India must have observed its influence on the natives. *Bhang* made from the leaves of the hemp-plant is, without exception, their favourite narcotic; they take it in the powder, and smoke the leaves, mixed with tobacco. Under its influence the most peaceable and quiet native will become violent, and, for the time, perfectly mad. I have witnessed its effect on the Indian native frequently. One case in particular I may mention. We had a remarkably steady khitmutgar (table servant), an excellent man, and generally to be depended on. One day, however, instead of waiting quietly at table, he rushed frantically into the room, seized the carving knife off the dinner table, and ran out brandishing it with intent to stab the *khánsámán* who had offended him; he threatened to stab everyone who opposed him, and in Malay language "ran amuck," his violent and ungovernable rage, entirely due to the *bhang* he had taken, being only stopped by his being forcibly knocked down and promptly secured.

It was thought that the cultivation of hemp in India for cordage would prove a paying source of industry to the natives; as, though the hemp-plaut had been grown in India from time immemorial, the natives did not employ it in the manufacture of cordage or coarse cloth, but grew it only for the sake of the drug before men-

tioned, which they prepare from the larger leaves and capsules without the stalks. *Gunjah* is the name for the flowering tops of the female plants. These are dried, and the resin allowed to remain in them. This resin, which is called *churrus* or *cherris*, exudes from the stems, leaves, and flowers. It is used in [illegible]. The seeds on pressure yield an oil, which is used in the preparation of emulsions. In cultivation of the hemp-plant for *bhang*, the natives transplant it much as they do rice, keeping a considerable distance between the plants, which increases their foliage, giving more material for the preparation of the drug. When planted for cordage it is sown very thickly and not allowed to form branches, as the longer the stem the more fibres will they yield. Many assert that the Hindoo gunjah or ganja and the English hemp are the same plant, i.e., the *Cannabis sativa*, and no difference can be discovered, though some think the Hindoo plant quite a distinct species. The sunn, or *Crotalaria juncea*, resembles our hemp also very closely, and this fibrous plant has always been used by the natives for cordage purposes in preference to the gunjah; it, however, though possessing many of the botanical characteristics of [illegible], is unquestionably an entirely distinct species, but [illegible] frequently confounded with it on account of its yielding a material so very similar, and from its being grown and cultivated in much the same way [illegible] quently spoken of as Bengal or Indian hemp, but is really the sunn, or *Crotalaria juncea*.

When the East India Company first directed their attention towards [illegible] its properties a valuable article of commerce, and increase the revenue of their possessions, [illegible] force the ryots to alter their method of preparing the plants when gathered, and treat [illegible] fashion, instead of their [illegible]

tem. They could not succeed in this; and for two reasons. First, the ryots are adverse to any change. "What has been must be" is their motto, and they flatly refused to cultivate and prepare *sunn* in any way except the one to which they were accustomed. Secondly, it was proved that, after all, *their* treatment was best. *Sunn* is a more delicate plant than hemp, and cannot stand such long immersion or such rough treatment, the former being positively injurious to the plant. So the natives were left to their primitive methods of treatment, which had been in use among them since the time when they first became acquainted with the value of the plant.

The time for sowing, in Mysore, the Deccan and Rajahmundry, varies; it is usual to plant at the beginning of the rainy season, and the crop is fit to be gathered in four months time. When the blossoms, which are yellow, commence to fade and fall, then the *sunn* is ripe. The plants are pulled up by the roots and placed in running water, standing root-end downwards the first day; the second, the plants are wholly immersed; they are then macerated three or four days by dressers, who stand in the water, break the stems of the plants in the centre, and beat the water with each portion until the fibres separate. They are then hung up to dry, and when ready the business of separating the fibres by hand, the fine filaments being divided with the fingers, commences. This is a tedious, laborious and expensive process; but on its being well and thoroughly done depends in great measure the marketable value of the material. *Sunn*, where properly treated, is well worth the time and labour bestowed on it; for it is much valued in the home market, commanding a good price, from £45 to £50 per ton for twine. When the fibre is prepared in England with patent liquid, Dr. Royle says in his "Report on the

Fibres of South India," it becomes so soft, fine, and white that it bears comparison with flax, and is said to be superior to Russian flax for fine spinning; in this state it is worth £80 per ton. In different parts of India the prices given for *sunn* vary considerably from rs. 1 to rs. 2-8 per maund: in Calcutta, it fetches from rs. 4-8 to rs. 5 per maund, and the prices are increasing. It figures also in our own quotations more frequently than it used as East India or Sunn. The price Dr. Royle put upon it, from £22 to £27 per ton, has fallen now to from £12 to £22.

Rope made from *sunn* is stronger when wet than when in a dry state: this has been proved by test. A dry rope in raising a weight of 148lbs. broke; the same rope when soaked lifted 222lbs. without snapping. The *sunn* fibres take tar well, and yield when well prepared good hemp and floss. In India they are chiefly used for making fishing-nets, cordage, gunny-bags, canvas, paper and so on. There is also the Jubbulpore hemp, which is the produce of *C. tenuifolia*, which Wight considers merely a variety of *C. juncea*, though Royle and other authorities hold that it is a distinct species. It resembles *sunn* in all particuiars, the fibre if anything being stronger.

JUTE.

Our chief supplies of jute were formerly derived from Russia, but now British India (Bengal and Burmah) figure more largely in our imports.

India is famed for the quantities of fibrous plants it contains of one sort or another; and Dr. Royle, in his interesting work on the "Fibrous Plants of India," gives descriptions of the various methods of growing and preparing the different fibres found in the country.

The *Corchorus capsularis* (Linn.), from which the jute of commerce is chiefly obtained, is an annual,

with alternate, oblong-acuminate, serrated leaves, calyx deeply 5-cleft with 5 petals, short peduncles, and whitish-yellow flowers, growing in clusters opposite the leaves; its 5-celled capsules are globose, wrinkled and truncated, with a few seeds in each cell; it flowers in June and July, the seeds being sown in April or May. When it has finished flowering the plants, which are then from 3 to 12 feet in height, are cut down quite close to the roots, their tops taken off, and they are tied together in bundles of from 50 to 100.

Then follows the macerating process. These bundles are immersed in water (not deep water) and kept under by pressure from above. They remain from a week to ten days, and by that time the outer bark has separated, the stems and fibres have become quite soft, and the bundles are ready to be taken out and untied.

After the stalks have been cut off, the fibres are dried in the sun, and when cleaned they are ready for the market. Jute is, however, very liable to spoil; its fibres, which are soft and silky, are very perishable, and too often are quite spoiled by remaining too long in the water, this being the time when the plants require most careful watching, indeed while immersed they require daily examination, to avoid too much decomposition; if they have been left too long, or have not been sufficiently looked after while soaking, they are commercially valueless, as they then quickly become rotten and decay. The great beauty of jute is, of course, its silky texture, which is only procurable by allowing the fibres almost to putrify before taking them out of water; for home use the plants remain a shorter time under water, and are therefore more strong and durable.

The trade in jute, both raw and manufactured, is very considerable, as may be gathered from the following figures taken from Mr. O'Conor's Review of the Trade of British India for 1877-78.

during 1877-78 from 5-8 rupees per cwt. to 6-4 rupees. It is thought that the prices for freightage from Calcutta will fall this coming year, and that the fibres will be thus cheapened; the crop, however, is not spoken very highly of, being deficient in some parts; if this is the case the present prices will hardly be likely to fall, but rather increase.

The last quotations of jute are from £20 to £22 per ton for "good;" from £15 10s. to £18 10s. for medium; and from £14 10s. to £17 for common.

The Americans have lately been making very active efforts to grow jute. Its culture to them is clearly a matter of necessity, for the country itself cannot produce anything like a sufficient quantity of material for bagging for their immense cereal export. A very large quantity of jute is now imported by America expressly for this purpose: about 78,000 tons is the estimate, including hemp and flax. When the fact is taken into consideration that even in 1870 the United States raised as much as 1,500 millions of bushels of grain of one sort or another, it is easy to understand the quantity of bagging material which would naturally be required. The bags made of jute cost very much less than bags would made of the more expensive hemp and flax.

The growth of their own material for bag making is therefore with Americans becoming a matter for serious attention; and companies are being formed, and factories established, for the express purpose of growing and manufacturing jute.

This touches India, and will undoubtedly affect the jute exports still more if the protective duties on jute are not removed, as it was anticipated they would be; for jute seed has been freely bought up by the companies in the States and distributed to planters to grow. It is a very easily grown plant; only in its preparation

requiring care, and this the far-seeing American is not likely to withhold. India, therefore, must look to it, and at once. Land capable of growing rice will g jute equally well, and in the value of the two c. there can be no comparison. That jute can be g well in India we have ample proof. In 1828 40,000 lbs. were exported from India; in 1860 ports of fibres (not all jute) had risen to 1,000,0 and some 300,000,000 lbs. of fabrics. In 1872 the shipments reached 700,000,000 over 300,000,000 going to England. While in 1876 the exports from Calcutta of raw jute, and manufactured fabrics, were valued at some £3,294,521.

The area under jute, though large—being estimated at above 900,000 acres—would well bear increasing; and if America still continued a large customer, which she would do if the price of jute fell a little, it would well pay India to give more attention to this industry. Even now, over a million natives are employed in it, one plantation, which manufactures some thirty million lbs. of jute into gunny bags, finding work for 4,500 workpeople.

OTHER FIBRES.

The list of fibrous plants found in British India is a long one. I may, without enumerating all those which have already been discovered, mention the following:—

The *Abelmoschus esculentus* (Wight and Arnott), the stem of which yields a pliant, strong, yet silky fibre, suited for the manufacture of gunny bags, paper, ropes, and strings; its fibres bear a very strong likeness to hemp.

Abelmoschus moschatus (Moenck), yielding a strong useful fibre.

Abroma augustum (Linn.), fibres a good substitute for hemp.

Abutilon Indicum (Don), producing a long silky fibre like hemp.

Acacia leucophlea (Willdenow). The fibre from the stems of this plant are excessively strong and tough.

Agave Americana (Linn.), and the *A. vivipara* (Linn.), both yield fibres. Those from the first named being in great request, it yields also—from the root—a ligneous fibre known under the name of "Pita thread." Various experiments have been made by Dr. Wight and Dr. Royle with this fibre, which was found equal to the best Russian hemp, being stronger and able to support a greater weight, than either coir, jute, or country hemp. (See "Fibrous Plants," Royle.) From the *Amphidonax karka* (Linn.) a fibre called *moonyah* is made, and the pineapple, or *Ananas sativus*, yields a very fine white fibre, which as a substitute for flax is perhaps as valuable as any fibre obtained in the country.

Bauhinia racemosa (Lamarch), and *B. Vahlii*, both produce fibres, which, however, have not been much experimentalized with.

From the *Bochmeria nivea* comes the beautiful "Rheea" fibre, of which lately a great deal has been heard. Its preparation is, however, difficult and attended with much expense, which is against its sale, other cheaper but not such really good fibres competing with it in the market.

Calotropis gigantea (Robert Brown) is spoken of very highly as a fibre-yielding plant by Wight, Ainslie, Royle, and others; the "Yercum," by which name the fibre is known, was proved by experiments in London to be stronger than Petersburg hemp, and of the same strength as Bombay or Jubbulpore hemp. *Corchorus capsularis* (Linn.), see "JUTE," and *C. olitorius* (Linn.), *Cordia angustifolia* (Roxburgh), *Crotalaria juncea* (Linn.), see "SUNN"; *Girardinia heterophylla* or Neilgherry nettle, *Hibiscus cannabinus* (Linn.) or Decanee

hemp, *H. sabdariffa*, *Ixora corylifolia*, *Linum usitatissimum* (Linn.), see "FLAX"; *Marsdenia tenacissima*, *Musa paradisiaca*, *Paederia fœtida*, *Pandanus odoratissimus* (Linn.), *Paritium tiliaceum*, *Saccharum munja* (Roxburgh), *S. sara* (Roxburgh), *Sansevieria Zeylanica*, "Moorva" fibre or bowstring hemp, *Sterculia villosa* (Roxburgh), *Urena lobata* (Linn.), *U. sinuata* (Linn.), are all more or less fibrous plants, to which many more names might be added. Readers curious on this subject cannot do better than refer to Royle's "Fibrous Plants," or to Colonel Heber Drury's "Useful Plants of India," or Roxburgh's "Flora Indica," from either of which much information may be obtained.

CHAPTER XIII.

FORESTRY.

THERE are few subjects more interesting at the present time than forestry, interesting to all countries, not to India alone. In many of the more recently opened-up countries, the forest growth is too luxuriant as in Australia and Tasmania, and the farmer must clear his land of trees before he can hope to cultivate his ground; but even in the places named the system of complete clearing has been too energetically carried out, and the preservation of trees is becoming a question for grave consideration.

In the United States, the evil effects of the rapid destruction of timber is much felt, and the Secretary of the Interior expresses his opinion strongly in favour of steps being taken to arrest the destruction of the forests, and preserve wooded land as much as possible from indiscriminate felling. In France, too, timber is getting scarce, also in Japan: and nearly every modern writer on India deplores the state that the wholesale destruction of forests has brought her into, a state from which it must take years of planting to recover the country. The influence of trees on rainfall has been considered at length by many clever writers, who have made the subject one of careful study, and the result of their research and investigations proves without a shadow of doubt that trees conserve and distribute moisture, a-

their presence affects plant-life as practically as if they really increased the amount of the rainfall; the physical cooling which takes place over a forest every night is owing to the great radiating power of the masses of green foliage it contains, by which the air is moistened and the dewfall increased. Besides this, there is a chemical action going on in the day time, which tends to lower the temperature over the forest surface. By indiscriminate clearing, a climate will in time become desiccated, but by re-wooding it will again become more humid, not by planting little patches of timber here and there, but re-clothing, as it were, hill slopes which have been denuded of their original growth. For the last few years great efforts have been made by the Indian Forest Department to prevent further denudation of the Indian Forests; but so far very little success has attended the movement, such vast extents of land had been cleared before the matter was really taken in hand that years must elapse before any real benefit can be felt, and the very arbitrary measures adopted at first by the Forest Department in stopping all clearing of forest lands over which they had control, led to great discontent amongst the natives, which might have been avoided had more judgment been exercised.

The peremptory stopping of the natural supply of fuel also caused distress amongst the people, and indirectly affected their agricultural prosperity, because in the absence of wood for fuel they were obliged to use manure instead of dressing their crops with it—as the more far-seeing ryots did; this led to poor crops on land which before yielded a fair average amount per begah; and, moreover, the land, being deprived of even this small amount of dressing, became more and more exhausted each year, the ryots becoming more poor also with each succeeding year. In pointing out the

disastrous consequences to the natives of too great severity in carrying out the orders of the Forest Department, a writer in the *Journal of Forestry* draws attention to the evils of having the officers of the Forest Department trained in French Forest Schools, the course of training in them being too much weighted with red-tape officialism to be useful in British India; "the ideas imbibed in a Forest School being especially adapted to the circumscribed rule and limited wants of the French nation, but totally inadequate to meet the ever varying wants and circumstances of the far spreading British dominions." Why not have the art of Forestry taught in the country itself? Have the young men trained to their work in the Indian Forests, under those who have had practical experience in them. Dr. Schlich, the Conservator of Forests of India, gives it as his opinion "that the training necessary cannot be learned anywhere else out of India;" he considers though that two years training at Nancy gives young men an insight into the work, and makes them more useful than they would otherwise be when they first come out. The system, however, on which forestry is carried on in France differs so much from that obtaining in India, that much practical knowledge has to be learned by those young men sent out from Nancy, before they are fitted to be placed in responsible situations.

A step in the right direction is the establishment of an Indian Forest school. Sir Richard Temple actively interested himself in the movement, looking upon its establishment as a desideratum. The sons of native gentlemen, and other well-educated natives, will be admitted as students; indeed, it is chiefly to make it easier for them to enter the Forest Department that the Central Forest School has been opened.

It is of great importance to interest natives of all

classes in the preservation of Indian forests. The higher and well educated class should be induced to bring up their sons with a view to forest appointments, and the poorer ryots should be encouraged to take an interest themselves in tree-planting. If they could be brought to understand the "why's" and the "wherefore's" of tree-planting and tree-preservation, then the Forest Department might succeed more generally in its efforts, less jealousy would be excited, and less discontent amongst those who now consider themselves wronged and ill-used because they are forcibly deprived of the timber they looked upon as their right. The small ryots and cultivators might be allowed to purchase young trees at mere nominal rates, or have the land they planted themselves exempted, or partially exempted, from taxation, or in some way be encouraged to cultivate trees for their own immediate benefit.

Out of about 2,000 kinds of wood grown in India not above 100 are known to the trade. Many of the unknown kinds are not only beautiful but useful, and require only to become known to command a sale. Dr. Hugh Cleghorn, one of our greatest authorities on Indian forests, has done more to enlighten the public with regard to Indian forest growth than almost any other person; and it was under his superintendence that the Forest Department came into existence, and has now ripened into such a useful institution.

The *Tectona grandis* Linn., or teak tree, is generally considered the most useful of all the timber-trees found in India. It is largely employed in house and ship-building, and is famed for its durability and strength. Moreover, it resists the attacks of white ants, and is for that reason almost invaluable in house-building.

The Nilambur teak plantations belonging to Government on the western coast are most valuable. They are situated some forty miles inland from Calicut, and

were originally established for the sake of supplying good teak timber for the use of the East India Company's dockyard at Bombay. And though the object for which they were started has long since dwindled to very small proportions, the forests remain and are of extreme usefulness and value. Dr. Cleghorn, when Conservator of Forests at Madras, took a great interest in these forests; and the gentleman who has had charge of them for many years is said to have obtained his appointment at the suggestion of "The Father of Forest Conservancy in India," as Dr. Cleghorn has been called. These plantations cover an area of 3,400 acres, and are said to have cost for working charges and supervision from 1840 to 1877, nearly two and a half lakhs of rupees. About one lakh and twenty-four thousand rupees have been recovered by the sale of thinnings. Colonel Beddome's late thorough inspection of these plantations is so far satisfactory that he anticipated "an enormous yield and very large profits." He believes that the trees in the plantations will grow and develope more rapidly than those in the natural forests.

In favourable ground the teak-tree shoots up very rapidly during the first ten years, after this time its growth is slower, and it is not considered mature until it is about 60 years of age, when it attains a girth of from 4 to 6 feet, reaching to 8 feet when from 80 to 100 years old. At that rate of growth the teak in the above plantations would not be fit for regular felling until the year 1904. Some time to look forward to for returns of the expenditure on it! Malabar teak is considered the best, especially for shipbuilding. The difference in its quality with that of Burmah teak being caused by the differences in the soil, exposure and humidity.

"The chief forest districts are those of Malabar, Canara, Travancore, and Goojerat, on the western coast

forests are in the district of Goomsur and in the Zemindary of Bodogoda; the rivers traversing these districts allow of the timber being floated down to the sea during the freshes. This tree, according to Cleghorn, grows remarkably tall and very straight. Quantities of young trees are cut down to form telegraph poles and posts for houses, those of larger size being used for public works and larger houses. When sawn longitudinally they make very good half round sleepers. On measurement the straight stump of a tree of two years' growth was found to be 12 feet high and 3 inches in diameter at base.

In North Bhaugulpore the sàl forests have been much injured and thinned by unscientific and indiscriminate cutting. In the Oude forests Captain Wood says the trees of second-class dimensions are about 65 years of age, but they do not attain their full growth, or first-class size, until they are about 95 or 98 years old.

The *Cedrela toona*, or Indian mahogany, is very like mahogany in its wood, but closer grained and lighter. It is very much used for furniture, and, as far as my experience goes, very useful for that purpose. Excellent chairs, tables, almirahs (wardrobes) being made of it. When new it is reddish in colour, but darkens and improves with age. It is generally called *toon wood*, and grows in dry deciduous forests, from 3,000 to 4,000 feet in elevation. It is raised readily from seed, and is a valuable timber, as it is hard, durable, free from worms, and takes a very high polish.

Colonel Beddome has made many attempts to raise real mahogany from seed. He has failed very often, but in the most recent attempt he succeeded in raising 12,000 seedlings from 34,000 seeds. The Madras climate is in every way fitted for the growth of this magnificent timber, which, if it could really be culti-

vated in India, would be a very important s
the timber of the country.

Diospyros ebenum (Linn.), or the true ebony c
merce, is a native of Ceylon; but the *D. melanox*
(Roxburgh), or Coromandel ebony, is very largely
There are other sorts, such *D. chloroxylon*, *D. cordi-*
D. reticulata, *D. ebenaster*, *D. hirsuta*, *D. mo*
D. tomentosa, *D. calycina*, &c., which all y
hard, durable, black wood, much valued on account of the depth of colour and high polish it takes. Ebony is not so much used as it once was: it does not hold glue as well as mahogany, and is now so frequently imitated, inferior woods being stained to look like it, that it is gradually falling out of use.

Pinus deodara (Roxburgh), or deodar-pine, is a tree very highly valued for its timber; and each year great quantities of deodars are felled for railway use. There are several varieties, *P. excelsa* and *P. longifolia* being both valuable trees. Large forests of deodars are found on the Himalayan slopes, in the Punjâb along the banks of the Ravee, Beas, and other rivers, in the Chenab forests, in Joonsar, Bawur, in the Kotee forest, and in many other places. Before the Forest Conservancy was established, these deodar forests were recklessly thinned, and a quantity of valuable timber wasted. Fresh plantations have recently been formed, and strict rules regarding the number of trees to be annually felled enforced. In the report of 1867, on the Ravee and Chenab forests, it is stated that there only remained of first-class deodars 17,500. The price of good deodar timber has risen very much of late years, owing to its gradually becoming more scarce. In 1850 the price of logs under twenty feet in length fetched 8 annas per cubic foot, in 1866 1 rupee, while in Lahore the price has risen to 2-8 rupees.

The N. W. P. forests, in which the deodar and chir

(*Cedrus deodorus* and *Pinus longifolia*) are the principal woods of market value, are now kept in much better order than they were. Fires are kept out, and grazing also, trees are carefully selected for felling, seedlings and young trees protected from damage in rolling, and the general rules of good forestry carried out fully.

Many trees have of late years been introduced into India from different countries, Eucaplipi, mahogany, carob, silk oak, Australian blackwood, maple, Spanish chestnut, cinchona, and others, some of which have succeeded beyond expectation. It may be as well also to mention a few of the less known in commerce but really valuable timber trees of India.

The Babool, *Acacia Arabica*, a hard wood, extensively used in India for gun-carriages, railway-sleepers, for fuel, &c.; it makes very good fire-wood, and is of rapid and almost spontaneous growth. Common in Bengal, Deccan, and Coromandel coasts.

Acrocarpus fraxinifolius, or shingle-tree, growing in the Travancore mountains and South Canara, used for furniture and building purposes, and in Coorg for shingles.

Albizzia amara, growing in Mysore, Bombay and Madras; the wood of this tree is very handsome, dark mottled brown; it is strong, close-grained, hard, durable and quite equal if not superior to teak and sàl in transverse strength and cohesive power. The natives use it very much for building, and in making agricultural instruments, beams, &c.

Artocarpus integrifolius, jack-tree; well known in India, at least, for its timber called jack-wood, which is used for furniture and general building purposes.

Bignonia suberosa, Indian cork-tree, which has a firm, white, close grained wood and takes a good polish.

Chickrassia tabularis, chittagong-wood, a light-

coloured wood, well veined, and taking a good polish, much used by cabinet makers for furniture.

Chloroxylon swietenia, satin-wood tree, also much used for furniture and for building purposes, more particularly for flooring. It grows chiefly in the Circars.

Dalbergia latifolia (Roxburgh), blackwood-tree; the wood of this tree is much used for furniture, it is one of the most valuable woods of Southern India; it grows chiefly in the Circar Mountains, S. Concans, and Travancore.

Dalbergia Oojeinensis and *Dalbergia Sissoo* are also good timber-yielding trees.

Enonymus crenulatus, a very hard, close-grained wood, suitable for wood engraving, and one of the best known substitutes for box-wood.

Ficus glomerata.

Ficus religiosa.

Gluta Travancorica, a valuable timber-tree; wood reddish, hard, durable, and takes a high polish.

Hopea Wightiana.

Icica Indica.

Lagerstrœmia parviflora, and *L. reginæ.*

Polyalthia cerasoides.

Prosopis spicigera (Linn.).

Sethia Indica.

Sonneratia acida.

Tamarindus Indica.

Terminalia coriacea, *T. glabra*, *T. tomentosa.*

Vitex negundo (Linn.)

May be mentioned, for all are good and valuable timber trees, besides many others that could be named.

From the reports of forest operations for the year 1877-78, a great deal of information is to be obtained. In the North-Western Provinces and Oude, the area of reserved forests is now 3,473 square miles; in the Dehra Doon the area enclosed amounts to 563 square miles,

the entire district only consisting of 677 square miles. In the Central Provinces 2,548 square miles are under forest. In the Hyderabad assigned districts the reserved forest area is 1,402 square miles, experiments having been tried here with new trees, *Eucalyptus rostrata*, several sorts of pine, and the carob-tree being introduced. In Mysore 442 square miles are reserved forest, the chief sales being of sandal-wood and the net profits on the year's working are estimated at 204,575 rupees. In Coorg the extent of reserved forest land is 295 square miles. In Ajmere there are 100 square miles of reserved forest land. The unreserved land in many of these districts has not yet been ascertained.

In the general review of the work done in all the departments issued by the Government of India it is stated that "the reserved forests amount to 18,113 square miles, as against 17,835 in the previous year." As, however, the unreserved land under forest has not been measured, the total extent of forest in the country cannot be estimated. The financial results show an expenditure of 32,00,175 rupees, the revenue being 55,76,141 rupees, profit 23,75,966 rupees. The effort to make the Forest Department pay *now* is however not the result to be striven for; the end to be looked to being the *ultimate benefit to the country* by the preservation and increase of its forest extent; and this can only be obtained by bestowing care on natural reproduction, in planting and extending the forests. It does not appear that so much has been done as might have been in these particulars, probably because the expense it would entail and the sacrifice of present income are too much considered. It should be borne in mind that, really speaking, the objects of the Forest Conservancy are not commercial, but the end in view is supposed to be the improvement of the country. If a profit can be obtained, without sacrificing the

money which should be expended in replanting and extending the forests, it is a point gained; but to gain the present profit, the future benefit should not be lost sight of.

Strictly speaking, Forestry can hardly be said to come under the head of Indian Industries; but the subject is one of such importance to our Eastern Empire, that I need not apologise for introducing it here.

CHAPTER XIV.

HIDES, SKINS, AND HORNS.

THE Indian exports of all these articles are considerable, and last year a decided increase was shown in raw hides and dressed hides, in skins of goats, kids, sheep, deer, and animals other than horned cattle, and horns. The chief quantity of raw hides is exported from Bengal; out of the total export of 1878-9 which was 606,678 cwts., 472,532 cwts. was shipped from Bengal. Much of this increased trade was occasioned by the United States, to replace stocks in the boot making trade, which, owing to the requirements of troops in the field in South Eastern Europe, received a great impetus.

Dressed hides are almost a monopoly of Madras, which exported out of the total shipments of 173,452 cwts., 139,088 cwts. These dressed hides go, the greater portion of them, to the United Kingdom. "Taking raw and dressed hides together," Mr. O'Conor states "the exports of the year represented the skins of 9,300,955 head of cattle. The average exports of the previous four years were at the rate of about 7,256,419, the highest number having been exported in 1874-75 after the famine in Behar." Here, again, we have a greatly increased export following a drought in Northern India; in the South and in the West the severity of the drought is apparent from the increase of 2,050,000 in

the number of hides. If we take at seven millions the normal number exported annually, we have here an unusual and abnormal mortality in cattle, evidenced from these returns, of about two million head. When we consider that even the normal mortality is far in excess of what it ought to be, it would be difficult to exaggerate the severity of the blow to the agricultural prosperity of the country which is implied by these figures.

The paucity of cattle now in India is an evil which has assumed an alarming character, and is due in great part to the incredible losses of stock from drought and also cattle disease. Mr. Hume states "that according to the census taken in the Punjâb, Central Provinces, &c., there is at present in India about one head of horned cattle to every two human beings. This would give about 100 millions of cattle, worth at the very lowest calculation £75,000,000." But if the cattle in India are to be allowed to perish, in the manner the figures quoted in the hide returns show they have done in these last few years, the stock must very materially diminish, more especially as but little concern is shown on the part of Government to look into the matter. Diseases of the most virulent type have been allowed to rage unchecked amongst the domestic cattle; plagues and droughts have swept away thousands on thousands of cattle, whole districts being devastated, depriving their owners in many cases of their whole means of subsistence; for, the wealth of India's vast urban population is to be found chiefly in their cattle; when these die, the ryots are in most cases too poor to replace them, and therefore their lands remain untilled, and they themselves too often starve. In his "Agricultural Reform in India" Mr. Hume has pointed out a remedy for this disastrous state of things, and one not at all impracticable. It

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is, to plant with trees a considerable area in every village or commune known to suffer severely in seasons of drought: with this result—the forest would give fodder for the cattle when the land around was parched and burnt up by heat and drought, as grass would grow in plenty beneath the trees. The question of how first to grow the trees being answered by allowing from five or seven years to elapse while the young trees were growing, keeping the forest fenced off and protected for that time, and then when seasons of drought occurred throwing them open to the villagers' cattle—that is, when other outside fodder was quite exhausted. If such a system was at once commenced in six or seven years' time Indian cattle would no longer die off in thousands from drought. While the forests were growing they would still be swept off as hitherto; but because we have neglected to look after the welfare of the Indian herds in the past, is no reason for us to put off beginning now to plant, as a provision for the future.

With regard to *skins*, the Indian trade is also more extensive now than it used to be, being larger in dressed than iu raw skins. The tanning industry in the North West Provinces has also increased, but the articles turned out are utilized in domestic consumption. The United States takes most of the raw skins (as with hides) and the United Kingdom the greater portion of the dressed. As hides and skins increased, naturally horns did also, and the exportations were 18,783 cwts. in 1878, as against 71,894 cwts. in the previous year, the value having risen from 12,80,051 rupees to 19,42,009 rupees. "Hides are 'raw' or 'green'—that is in the state they are taken off the carcase; or dressed with salt, alum, and saltpetre to prevent them from putrefying; or they are cured and tanned." The South American hides bear the highest name, and large quantities of them are imported by the United Kingdom yearly, as well as

from India, Prussia, Denmark, Holland, Belgium, France, Brazil, Peru, Australia, and other parts. The prices from the various countries differ, East India best from 4d. to 13d. per lb.; second, $3\frac{1}{2}$d. to $10\frac{1}{2}$d.; third and fourth, 3d. to 8d.; Australia salted, $3\frac{1}{4}$d. to 6d.; Brazil dry, 9d. to $10\frac{1}{2}$d.; dry salted, 5d. to 8d.; and so on. East India deer horns fetch from 40s. to 72s. per cwt.; buffalo, 20s. to 62s.; tips, 18s. to 28s.

CHAPTER XV.

GUMS AND RESINS.

It is impossible to describe minutely in a limited space all the various gums and resinous products of India, especially as many have not as yet been properly developed, and others are comparatively unknown. I have therefore only taken a few of the best known under each of the following heads:—

I.—True Gums.
Pseudo Gums.
Astringent Gums.
II.—Gum Resins.
III.—Resins.
IV.—Oleo Resins.
V.—Elastics and Guttas.

Of the true gums the most important is undoubtedly—

GUM-ARABIC.

This is the purest of all gums, being in fact a genuine gum, while many of the substances commercially classed as gums are either resins, or gum-resins. Gum-arabic consists of a principle termed *arabin*, of which it contains about 97 per cent., its other parts, according to Gay-Lussac and Thénard, consisting of carbon, hydrogen. and oxygen. The true gum-arabic is the produce of different kinds of acacia, the best being

5 parts of good glue are macerated in 20 parts of water for 24 hours, adding 20 parts of rock candy and 3 parts of gum-arabic. Essential oils, alcohol, and oil of cloves will preserve gum solutions, and prevent their turning sour.

The acacias which yield this gum are also valuable for timber, the babool being very much used all over Bengal. As, however, the tree is not a large one, the timber is only useful for small purposes. Cleghorn says that in Sind it is useful for railway sleepers; it has also been recommended for planting in stations and along roads where shade is needed, being easily grown and of quick growth; but hitherto it has hardly met with as much attention as it really deserves. The babool is also a yielder of "lac" and the "Coccus Indica" is found attached to its branches.

The *Acacia Farnesiana* is, though small, a durable wood, and a gum also exudes from its bark, which is used extensively by the natives where it grows. Under the head of true gums may also be mentioned those produced from the—

Acacia catechu (Linn.), called "Kheir gum."
Acacia speciosa (Willd.), "Siris gum."
Acacia leucophlæa (Willd.), "Gum Bassora."
Anarcardium occidentale (Linn.), "Cashew gum."
Bassia longifolia (Linn.), "Eloopa gum."
Borassus flabelliformis (Linn.), "Palmyra gum."
Buckanania latifolia (Roxb.), "Chirowji gum."
Conocarpus latifolius (Roxb.), "Veckale gum."
Elæodendron paniculatum (W. and A.), "Jumrasi gum."
Feronia elephantum (W. and A.), "Wood apple gum."
Odina wodier (W. and A.), "Kenni-ke-gond."
Vachellia Farnesiana (W. and A.), "Guya babula."

PSEUDO GUMS.

Sterculia urens (Roxb.), "Kuteera." This gum is known as false tragacanth. The true tragacanth is not found in India, this being of a much coarser description, and chiefly used to adulterate the true tragacanth. There are various other species of *Sterculia*, all yielding gums which are generally classed under the name of "Kutira gum" or Kuteera.

The *Moringa pterygosperma* (Gœtn.), which is common in the gardens of the Peninsula, yields the "Moringa gum," which has also been known under the name of Mochrus or Mocharras; it resembles the Kuteera gum in many respects, but being much darker in colour is considered inferior to it.

ASTRINGENT GUMS.

Of these the most important is generally considered to be

KINO.

For some time the origin of this astringent gum remained undiscovered; but Dr. Royle brought satisfactory evidence to prove that much of the kino of commerce was produced by the *Butea frondosa*, a common tree growing freely in almost every part of India. Dr. Pereira's researches also show that kino is a vegetable extract, or gum, and that it is obtained from the *Pterocarpus marsupinus*, as well as the Buteas, which tree grows in both East and West Indies, Africa, South America, and Australia. This gentleman also discovered that the gum called *Gummi rubrum astringens* by druggists, and used by them under that name, was really kino.

Roxburgh remarks of the kino obtained from the *Butea frondosa*, "that it is so like that of the *Pterocarpus marsupina* that one description might well suffice for both, with respect as well to appearance as to the action of chemical re-agents." The *Butea frondosa*, or "bastard teak," is an ordinary-sized tree with pinnately trifoliate leaves, densely pubescent corolla, and bright scarlet flowers, which appear in December and February. The juice is obtained from the stem, in which incisions are made; it is usually known as "Bengal kino"; it is curious that the Sanscrit name of this tree should be *Kinsuka*.

M'Clelland writes of it as a useful gum, and says that the province of Pegu could supply any quantity of it. The *Butea superba* (Roxburgh) and *Butea parviflora* also yield a similar juice, which on exposure to air concretes into gum.

"Bengal kino" is of ruby-red colour, shining, very brittle, without smell, with a bitter astringent taste, and when chewed—it is soluble in the mouth—tinges the saliva red. It is also used by the natives to precipitate indigo, and in tanning, as it contains a large quantity of tannin, as much as 70 or 75 per cent. It readily dissolves in water, which it colours deep red, and is soluble in alcohol. The kino yielded by *Pterocarpus marsupium* differs but little if at all from the Bengal kino; it is found in great quantities at Cuddapah, where Cleghorn, in his "Forests of India," says that the estimated number of trees in the Cuddapah forest is about 50,000. The exports of kino are chiefly from Malabar.

It is a much larger tree than the bastard teak, giving very good timber, which is of a deep brown colour, and much used in cart building. It grows chiefly in the forests of Cuddapah and North Arcot, on the Malabar and Canara Ghauts, on the Eastern Ghauts, and in the

southern parts of Kurnool. The Conservator of Forests, in his Report to the Madras Government in 1867, says that the price (then) of the roots kept steadily at £3 10s. a ton, sometimes rising to £4.

GUM RESINS.

Gamboge I have described under the head of "DYEING AND COLOURING MATERIALS." It is not necessary therefore to mention it here.

Garcinia mangostana (Linn.).
Garcinia cambogia (Desr.).
Garcinia cowa (Roxb.).
Garcinia Griffithii (And.).
Garcinia pedunculata (Roxb.).

All yield gum-resins, besides *Garcinia pictoria* (Roxb.) and *Garcinia morella* (Desr.) from which the gamboge of commerce is, as already mentioned, procured.

FOETID GUM RESIN.

NARTHEX ASAFOETIDA (Falconer).

This plant is found chiefly in Persia, Turkestan and Afghanistan; but is also met with in the [illegible] Western Himalaya at Kunawur [illegible] and in the Upper Chenab. Kempfer thus describes the root: —perennial, tapering, ponderous, increasing to the bulk of a man's arm or leg, covered with a blackish rough bark, beset near the top with many strong rigid fibres; its internal substance white, fleshy, abounding with a thick milky juice, which has an excessively strong fetid alliaceous smell. Stem two or three yards high, or more; 6 to 7 inches in circumference at the base, smooth; radical leaves, nearly two feet long; [illegible] reddish brown, like that of a peony, [illegible]

and darker. The mode of collecting it is now pursued in exactly the same way as it was 160 years ago.

In Afghanistan the plant grows wild, the chief supply being obtained from the hills north of the Bolan Pass. In April and in May, Dr. Elmslie says, incisions, either long cuts producing lumps, or pricks yielding tears, are made across or round the crown of the root. Gum exudes, and is collected for about a fortnight from these cuts, and is scraped off and put into cups.

The best asafœtida should be clean, fresh and strongly scented, of a pale red colour, variegated into a number of fine white tears, which appear like marble when broken, but on exposure to the air turn violet or red. In England it is used chiefly as a medicine, being valued at from 12s. to £4 per cwt. A great portion of the gum is re-exported from our shores, France taking a large share, as in that country asafœtida is used in cooking as well as in medicine. Specimens have been brought to England from Calcutta, Bombay, Nassick, and Cabul. In Bombay asafœtida is called "hingra" and is exported to Europe; but this is obtained from the *Ferula Persica*, and differs very much from the asafœtida found in most European shops, being generally met with in large masses enclosed in cowhide, the colour of treacle, and, when fresh, of the consistence of yellow wax. It fetches about 7 rupees a Surat maund, while the real asafœtida is worth about 45 rupees for the same quantity.

The *Dorema ammoniacum* (Don.) produces the "ammoniacum" of commerce. This gum exudes in tears or masses from the stem of the root, which is a perennial one, the tears are pale cinnamon, brown in colour, and break with a smooth, shining white surface, the masses are composed of agglutinated tears, and when cold are hard and brittle, but are easily softened by the application of heat; it has but a faint smell, and is bitter

to the taste. In 1871-72 the exports from Bombay of gum ammoniacum to the United Kingdom were 453 cwts.

FRAGRANT GUM-RESINS.

Balsamodendron myrrha, myrrh. The chief portion of the myrrh imported by the United Kingdom is brought from India; formerly "East India myrrh" was the only kind imported from India—but now myrrh of various kinds comes from thence.

It exudes from the bark of the tree, and is at first soft, oily, and of a pale yellow colour; it becomes darker as it dries, the best being that of a reddish-brown colour, uniform on the outside, speckled or streaked with white inside, unctuous to the touch, but not tenacious, having a strong smell, and a bitter biting taste. It is usually imported in chests.

Balsamodendron Mukul (Hook.).—This yields the gum resin called "Googul." It is obtained by incisions made in the bark of the tree, and is collected from September to February. In Bombay it is valued at about 2 rupees per maund, and is generally in a very impure state, little or no trouble being taken by the natives who collect it, as they merely make long incisions in the tree with a sharp knife, and allow the gum to fall on the ground, gathering it up from it. A species of gum, also called "Googul," is obtained from the *Balsamodendron pubescens* (Stocks).

The *Mangifera Indica* is common everywhere in India. The gum-resin it yields is called by the natives "Habk-hadie," and sometimes "mango-gum;" which, however, is not the correct name; for the mango-gum received under the name of Habk-hadie, is of a darkish brown colour, the "mango-gum" being, as stated in the "Punjab Products," a white gum.

13

STYRAX BENZOIN.

The tree which produces the substance known as benjamin, or benzoin, is found growing all over Asia, and in Sumatra and Siam. The East Indian *Terminalia angustifolia*, according to Royle, produces a species of benzoin procured by pounding the tree; it is collected in large white and light brown pieces, and dried into a powder.

Trees yielding benzoin do not produce it until the sixth or seventh year. They are easily grown, the seeds being usually sown in ricefields. Beyond keeping the shrubs as they grow free from weeds, little attention is bestowed upon them. When they are ready to yield their juice their bark is cut obliquely, at the origin of the chief branches. The juice at first flows in quite a liquid state, but hardens on exposure to the air and sun. It is scraped off the bark with a knife. Trees are said to yield from three to four pounds each, but rarely continue in bearing more than ten years. During the first few years the exudations are white and pure looking, but in after years they deepen in colour to brown. It is packed for exportation in large masses, in casks or chests; the purer it can be procured in colour, the better it is and the more valuable.

In 1863, out of 3,342 cwts. imported, 2,880 are placed to the credit of India, Singapore, and Ceylon, at a value of £25,059. The Siam fetches the highest price,and is generally met with in small flat pieces. As the various benzoins imported differ very much in quality, they are classed 1st, 2nd, 3rd, according to the prices they command, which prices range from £5 to £45 per cwt. Benzoin is soluble in alcohol, from which by the addition of water it can be precipitated. It has little or no taste, but an agreeable smell; for the sake of which it is used in preparing incense, much of which is imported by the

United Kingdom, being re-exported to France, Greece, and other Roman Catholic countries for use their churches.

Benzoic acid is prepared chiefly from benzoin. exports of benzoin from the Bombay Presidency into the United Kingdom in 1871-72 were 385 cwts., in 1872-3 1,093 cwts.; and there is reason to suppose that, with greater attention paid to the purity of the gum, the exports of the article will continue increasing.

OLIBANUM.

Olibanum is another gum-resin, so like frankincense that it is very frequently confounded with it; it is, however, produced from the *Boswellia thurifera* (Roxburgh), and also from the *B. glabra* (Roxburgh), while frankincense is yielded by the *Juniperus lycia*.

The *Boswellia thurifera* is the Indian olibanum tree, which Dr. Birdwood recognizes as a single species; it is a large handsome tree, affording excellent timber, hard, durable, and heavy. It grows chiefly in the Coromandel mountains, in Belgaum, and is also common in Central India, Bundelcund, and about the Bisrumgunge Ghaut; the *Boswellia glabra* growing in the Deccan, and on the Coromandel coasts and mountains.

This resin is called by the natives *Koondur* or *Cundun*, and is very generally used by them as an incense, to burn at their numerous religious ceremonies. It is fragrant, bitter, and pungent, burns rapidly, and while burning emits an agreeable smell. It is collected much as other resins are: the bark of the tree is wounded, the resin on exposure to the air becomes hard and brittle, and is then scraped off the trees.

The best olibanum is found in semi-transparent tears, pinkish in colour, and when warm adhesive. This is the sort imported from Arabia, and is usually considered

superior to the Indian kind, which is found in pieces often as large as a walnut, of a deep yellow colour, sometimes reddish, and covered outside with a sort of white powder. This gum-resin is undoubtedly the frankincense of the ancients. It is imported in chests containing from three to four cwts. each, from India and the Levant, the best or Arabian kind coming from the last named.

In 1867, McCulloch tells us, 8,537 cwts. of olibanum were imported by England, the value, reckoned at £3 8d. per cwt., estimated at £25,915, shipped chiefly from British India. Much of this was re-exported to Russia and Turkey. It is difficult to arrive at correct recent estimates of the quantity now imported, as olibanum is classed under the general head of "Gums and Resins." See "EXPORT SHEET."

DRAGON'S BLOOD.

The greater portion of this resinous substance is obtained from different species of *Calamus*, or genus of palms, except that yielded by the *Pterocarpus draco* of America, and the *Pterocarpus santalinus*, or red sandalwood, found on the Coromandel coast, in the Godavery forests, in North Arcot, and Cuddapah. Among the *Calamus* genus which produce dragon's blood are *C. rotang*, found in the S. Concans in Bengal, and also on the Coromandel coast; *C. draco*, a native of Sumatra and the Moluccas; *C. rudentum*, also found in the Moluccas; *C. verus*, a native of Cochin China; and *C. petræus*.

The name of "dragon's blood" is derived from the redness of the colour, and from the name of the tree which produces the finest sort—the *Pterocarpus draco*, a native of Africa, America, and various parts of Asia.

There are several kinds of dragon's blood known in

commerce. Dr. Pereira enumerates the following:—Dragon's blood in the reed (*Sanguis d. in baculis*). This is in rods or sticks from one to one and a half feet in length, about as thick as the finger, and of a dark reddish-brown colour. These rods are carefully wrapped in palm fronds and bound around with cane slips. This kind is obtained from the calamus genus, generally supposed to be from *C. draco*. Dragon's blood in tears (*Sanguis d. in lachrymis*) generally obtained in lumps or masses of irregular shape. Dragon's blood in grains or powder (*Sanguis d. in granis*) is the dust of the fruit of *C. draco*. Dragon's blood in oval drops, which are imported wrapped usually in fig-leaves. "Lump dragon's blood;" and "Dragon's blood in cakes," of oblong shape, about the size of half a brick, and of a good quality.

The fruit of trees yielding this substance are when ripe covered with a dry reddish resin, they are collected when matured, and allowed to dry until this resin falls off. This is melted by artificial heat, and then shaped into different forms. The natives prepare dragon's blood also by shaking the ripe fruit in bags, and then collecting the resin separated from the fruit by the process, melting it, and shaping it into pieces the size and form of a bean. The best kind is made by subjecting the fruit to the action of steam, the resin as it exudes being scraped off. There are also other ways of preparing the substance common in India.

When pulverized dragon's blood is in colour a fine crimson, in bulk it is a dark red; it has no smell nor taste, is insoluble in water, but soluble in alcohol, and the red solution can be turned yellow by the addition of an acid, the red colour being again restored by the use of an alkali. It is friable, breaks smoothly and easily, ignites readily, and when burning gives off a fragrant smell. The colouring matter it contains is known as *dracina*, which name was given to it by

Melandri; it is not, however, an alkaloid as he fancied, but has been proved by Herberger, who analysed it, to be a sub-acid. The usual method of obtaining the colouring matter is by macerating dragon's blood in water acidulated with sulphuric acid; this becomes yellow, but hardly acts on the resin itself, which is in this state of a fine red clour, and fusible; so much so that it can be drawn into threads. At about 130 degs. it melts, and when solidified is a deep crimson. It is used as an ingredient in various sorts of varnish, and in lacquers; also to stain marble, for which purpose it is dissolved in alcohol; it gives the marble a red tinge, for fine designs the marble is cold when the colour is applied, but if the stain is required to penetrate deeply, it is heated before it undergoes the process. Wood also is stained with dragon's blood, and it is used in medicine, though not so much now as formerly.

It is difficult to obtain any accurate returns of the quantity of Indian exports, as this substance is usually classed with other resins under the head of "Gums and resins," though, properly speaking, as Dr. Cooke points out in his Report on the "Gum, resins, oleo-resins, and resinous products" of India, the substances known as dragon's blood in their relation to gum resins occupy much the same position the various Kinos bear to the gums, except that the large proportion in their composition would favour their retention amongst resinous substances.

RESINS.

Various trees in India yield the resin called Dammer, or Damar. The white damars of the Northern Circars are produced from the Shoreas. The *Shorea robusta*, or Sàl, yields a damar of a colour varying from pale amber to dark brown, almost black. The Malay damar

is known by the name *Damar-batu*; the Javanese is called *Damar-selo*; and the white varieties *Damar-patch*, or white resin, which is softer than the other sorts.

The *Canarium strictum*, or black dammer tree, is found in Tinevelly, Malabar, the Pulney hills and Trichore forests; the resin obtained from it is of a deep brown yellow colour, when held betwixt the eye and the light; but on the tree it appears perfectly black. In India it is used for the same purposes, we use pitch, and in bottling liquids to secure the corks, also for varnishes; its price Major Beddome estimates at 8 rupees for 25 lbs. which is a very much higher value than any resin fetches in English markets, so that it is not probable that any demand outside the country will obtain for it.

Good dammer has neither taste nor smell, is slightly soluble in alcohol, and entirely so in turpentine, ether, or fixed oils; it is chiefly used in varnish. Dammer varnish is made by taking ten parts of gum-dammer, five parts of gum-sandarach, and one part of gum-mastic; digesting the whole at a low heat with 20 parts of spirits of turpentine, and shaking frequently. It should be of the consistence of syrup when ready for use, and spirits of turpentine is added until it is in this condition. Mixed with oil of turpentine in the proportions of two parts of colourless dammer to two and a half parts of oil, it is a very good varnish for lithographic drawings, maps, &c.

The well-known value of the sál tree need not here be alluded to. (See "FORESTS.") These trees which produce dammer yield it in very large quantities, and as it exudes through the bark incisions have not to be made to procure it, as in the case of other gums and resins. It is much used in Bengal and in China, for the same uses to which pitch is applicable, in paying the bottom of ships. Crawford, in his "*Eastern Archi-*

pelago," says that in Borneo, by giving a little previous notice, any quantity almost can be obtained, and very cheaply, only half a dollar being charged per picul.

The *Vateria Indica* (Linn.),
V. acuminata (Hayne),
Vatica lancœfolia (Blume),
V. Roxburghiana (Wi.),
Hopea odorata (Roxb.),
H. micrantha (Hook.),
H. parviflora (Bedd.),
Canarium strictum (Roxb.),
C. Bengalense (Roxb.),
Dammara orientalis (Lamb.),
All yield damars of different kinds. The resin obtained from the last named is brought to England from Singapore and sold under the name of East India dammar.

The *Trachylobium Mozambicense* (Peters), which tree is really a native of Eastern Africa, produces the resin known commercially as "Bombay animé," "Indian animé," "Gum animé," and "Zanzibar copal or animé." The chief African centre of supply is the Kwale district, where there are about a dozen stations for carrying on the copal trade.

The true copal is a resin, which is produced from the *Rhus copallinum*, which is a native of Mexico, but other varieties of this substance exude from different large trees which are found in America, Africa as mentioned above, and the East Indies. The copal brought from the last named source is the resin which is produced on the *Vateria Malabarica*, or Indian copal, or Piney varnish tree, as it is often called.

This is a large tree, with a whitish bark, dense foliage, alternate leaves, handsome flowers, and one-seeded capsules. It flowers in January and March, and is found chiefly in Malabar and Travancore. The Piney

resin, which it yields, much resembles cop[illegible]ing applicable for all the same purposes, making an excellent varnish. The resin is obtained by cutting a deep notch in the tree, from which as the resin exudes it is dried by exposure to the air and scraped off. It is hard, shining, and is very much like amber, in colour varying from pale green to yellow, but the green tinge usually predominating; it is insoluble in water and very slightly so in alcohol. In Mr. Broughton's report on it he says:—"This substance has long been known, and its properties and local uses have been frequently described. It is also not unknown in England; and I apprehend that its cost (and perhaps also ignorance of its peculiar properties) has prevented its becoming an article of more extended commerce. The finest specimens of piney resin are obtained by making incisions in the tree, and are in pale green translucent pieces of considerable size. The resin that exudes naturally, usually contains much impurity. In most of its properties it resembles copal, but it possesses qualities which give it some advantages over the latter. It is easily soluble in chloroform, and thus might find a small application as a substitute for amber in photographer's varnish, and like copal it can be dissolved in alcohol, with the addition of camphor. It differs most advantageously from copal by being at once soluble in turpentine and drying oils, without the necessity of the preliminary destructive fusion required by that resin, a process which tends greatly to destroy the colour of the varnish. The solution of the piney resin in turpentine is turbid and milky; but by the addition of powdered charcoal and subsequently filtering, it yields a solution transparent and colourless as water, and a varnish which dries with a purity and whiteness not be to surpassed; this solution in turpentine readily mixes with the drying oils. It is on these

properties of the resin that its chance of becoming an article of trade will depend. In price it cannot compete with copal, whose supply to the European market is regular and abundant. "Major Beddome informs me," Mr. Broughton adds, "that the cost of piney resin delivered on the sea-coast would be about 6 rupees per maund of 26 lbs. The present price of the best copal in the English market is but £26 10s. per ton." A fatty oil called piney tallow is made from the fruit of this tree which is bruised and boiled. An oil of agreeable smell is also produced from the resin by destructive distillation. The chief use of the piney resin and copal is for varnishing. Copal forming the principal ingredient in very many varnishes; for fine paintings, for cabinets, and in carriage varnishing copal is used, a polish being also made by mixing it with gum camphor and ether, and digesting with alcohol.

The *Canarium commune* (Linn.) yields the concrete resinous exudation known as *Elemi*. This tree is a native of Manilla, and the resin is imported into England from thence; but the tree is found in India under the name of Java almond, though the resin which exudes from it is not taken much notice of except by the natives, who seem to be aware of its usefulness.

OLEO-RESINS.

Under this head Dr. Cooke classes the various "balsams," such as—

Balsamodendron Berryi (Arnold),

B. Gileadense (De Candolle),

And others.

Of the trees yielding wood oils may be mentioned the—

Dipterocarpus turbinatus (Gœrtn.), which yields the "Gurjun oil."

D. incanus (Roxb.).
D. alatus (Roxb.).
D. tuberculatus (Roxb.).
Dryobalanops camphora (Coleb), from which is procured "camphor-oil."
Liquidambar orientale (Miller), yielding "liquid storax."
Amongst the trees found in India, British Burmah, &c., which produce natural varnishes I may name the—
Melanorrhœa usitatissima, which yields the celebrated Burmese black varnish, or *Thit-tsi*.
Holigarna longifolia (Roxburgh),
Sunecarpus anacardium (Linn.),
S. Travancorica (Bedd.),
Which all produce natural varnishes, mostly black or deep coloured.
The best known coniferous trees from which are obtained turpentine and tar are the—
Pinus longifolia (Roxb.).
P. Gerardiana (Wall.).
P. Massoniana.
P. Latteri (Mason).
Cedrus deodara (Loudon).
Tectona grandis (Roxb.).
Sethia Indica (W. and A.).

ELASTICS AND GUTTAS.

Under this head I may class CAOUTCHOUC. This substance is known by two names, Indian rubber or gum elastic, and caoutchouc. It is produced by several kinds of *siphonia*.

The greater portion of caoutchouc imported comes from Brazil, South America, and Central America, and is the juice of the *Siphonia elastica*.

Caoutchouc, curious as it may seem, was not known in Europe until the commencement of the eighteenth century, and then was looked on as a great curiosity. Its real properties and extreme usefulness were first made known by La Condamine and Bouguer, who were sent to Peru by the Academy of Sciences in Paris for the purpose of obtaining a correct admeasurement of the meridian. Being naturalists also, they did not confine themselves to only one branch of knowledge, but discovered among other things from what tree caoutchouc was procured, and how it was made. They found a tree at Esmeraldas in Brazil, which the natives called *hevé*, from which on incision a milky juice exuded, the Indian rubber of commerce.

The same substance is obtained from other trees which are found in tropical regions, *i.e.*, the *Ficus Indica*, the Indian caoutchouc-tree, the *Artocarpus integrifolia*, *Cryptostægia grandiflora*, and *Urceola elastica*. The fluid of the latter is, however, prepared in a different way, and is known as white Indian rubber, being dried in solid flat pieces.

The *Ficus elastica* (Roxburgh) is a tree from 30 to 40 feet in height, with firm, glossy, rather thick oval leaves. The fruit is also oval and smooth, about the size of an olive. It flowers in March and April, being found chiefly on the Khassya mountains and Juntipore hills. Drs. Royle and Roxburgh both think highly of it, and the latter has given a great deal of information respecting it in his Flora Indica. Howison and Falconer have also written on the subject.

The juice of this tree appears to be little if at all inferior to the South American caoutchouc; it is equal in elasticity to it, and both lighter and less offensive to the smell, only it is so badly collected, and so mixed with impurities that it is not much thought of, though possessing all the most valued properties of

Th...

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CATECHU, OR CUTCH.

There are several different sorts of catechu, but the most general and the most usually met with in commerce is that obtained from the *Acacia catechu*, a small tree which grows in great abundance in Hindostan, and also in the Burmese Empire. An interesting account of its manufacture will be found in the *Indian Agriculturist* for July, 1879, from which I extract the following :—" All over the high country (with a red laterite soil) that extends from the west of Burdan district to right across the Soam river, there is a great growth of scrub jungle, composed in the more damp portions of stunted soil, and in the more dry portions of mimosa, acacia, zizyphus, &c. Towards the Palamow district, and on the high land bordering on the Soane, the poorer people take advantage of the products existing in these jungles to help them in earning a portion of their subsistence.

After the rains are over, and the scanty crops have been gathered and garnered (say in March, April, and May) the country begins to dry up in a way that no one living in the lower portions of Bengal can imagine. It is then that the poorer people betake themselves to their friendly jungles for pecuniary help—and the mimosas and acacias are laid under contribution. They judge of the time for catechu, or *cutch* manufacturing operations very nicely; they see the leaves of the khair (*acacia catechu*), begin to brown, and know from it that the sap is fit for use. They then choose some old trees, and fell them (cutting as near the surface of the ground as possible). The trees so felled are cleared of branches, and the trunk and stem are cut up into logs of from 18 inches to 2 feet in height. These logs or pieces of wood are then laid on some rocky spot to dry in the blazing sunshine. After drying thus for

three or four days, the bits of wood are taken and hacked into chips of from 1 to 2 inches square, which are packed loosely in earthen pots or *chattees*, water is then poured into them till it overflows at the mouth, after which the pots so charged are put away carefully in some quiet place for two or more days to allow the water to permeate the chips.

When the manufacturers are not in a hurry, they wait till the water in the *chattees* is of a red colour before they deal with the contents; but when pressed for time they set to work it up at once.

A fireplace of very ingenious construction is dug out in the ground, and the pots charged with the chips and water are placed on it, a fierce fire is then kindled under them, and kept on burning until boiling point has been attained. It is continued till the *chattees* prove that about a third of the water they contained has been evaporated. The fire is then drawn, and the remaining juice poured off in other *chattees* or earthen tubs. The chips that remain being spread out to dry for a second boiling, or fuel as appears best.

The clean juice is again set on the furnace to boil, and that is kept boiling for about five or six hours, till it thickens into a syrup. At this stage of the manufacturing the fire is reduced to a steady blaze, and the syrup stirred, off and on, until it begins to string. If the cutch is merely for local consumption, the simmering mass is kept on the fire till it is fit to set, when it is poured into holes dug in the earth and lined with leaves. It is allowed to harden in these holes till it can be handled, when it is taken out and placed in bags, or otherwise.

If, however, the *cutch* is manufactured to pay off a *mahajun's* advances, or for exportation, the men mix a large quantity (say about a third) of ashes to the stringing, syrupy juice; and after taking care to stir it

up well, pour out the stuff into holes in the earth, as before, when it hardens very soon, and is taken out and sent for sale.

"From the result of *cutch* manufacture carried on by me (this writer adds), I have found that fifteen seers of chips produced seven and a half chittacks of pure *cutch*; about 30lbs. of chips yield 15 oz. of cutch.

"The prepared *cutch*, or *khair*, is cut up by the *mahajuns* (who have no wholesale business) into little squares each weighing about an ounce. These are sold at from half to threequarters of a pice each; the cost of making them is about one pie each, so there is plenty of margin to work on, more so when the addition of a third of ashes to the *cutch* is not included in the cost of production, and is included in the selling figure." Before its source was finally discovered it was thought that it was dug out of the earth, and it was called *terra japonica*, as really in its hardened state; and from the darkness of its colour it did resemble a mass of earth. The catechu or *cutch* obtained from Bombay is considered better than that from Bengal.

It is imported in various forms; thus we hear of "cake catechu," "Pegu catechu," "Bengal catechu," and "catechu in balls," and the price of the article varies with form and quality. It is largely used in medicine, as it is the most powerful astringent of its kind; it is also used as a masticatory, being mixed with betel nut. The natives make an ointment of extract of catechu, mixing it with alum, white resin, and olive oil, and use it for ulcers, considering it a very valuable remedy. In Europe it is valuable chiefly for its remarkably astringent powers. Its most important economical use is as a dye and tanning drug; for the latter purpose it is more especially esteemed, as it contains a very large proportion of tannic acid.

The *Areca catechu* (Linn.) also yields a species of

catechu—it is this kind which is mixed with betel-nut—but it is of inferior quality to that obtained from the *acacia catechu*.

The *Isonandra acuminata* (Lindl.), or Indian gutta-tree, was first noticed by Mr. Lascelles in the Wynaad forests. It is a large tree, and has a very extensive range. The exudation from the trunk bears a decided resemblance to the gutta-percha of commerce. It is procured by tapping the tree. When fresh the gum is of a milk white colour, the larger lumps being of a dull red. In its crude state it is unfit for ordinary waterproofing purposes; until, therefore, it is better known and the difficulty of its imperfect waterproof properties overcome, it is not likely to be commercially of very much use.

In the Malay Peninsula recent investigation has brought to light some new gutta-producing plants. Mr. Murton, in an appendix to a report of an expedition to Perak lately made by him, names the following varieties:—

Gutta-soosoo.
Gutta-taban.
Gutta-rambong.
Gutta-singgarip.
Gutta-putih-sundek.

The second of these is the gutta-percha of commerce, known under the name of *Isonandra gutta* (Hooker), for a long period, but now botanically known as *Dichopsis gutta*. It is found on Gunong Mera and Sayong, and Bujong, Malacca; also in Perak. The milk is obtained from this species by cutting the tree down, cutting off the top, which is too small for ringing, and then ringing the rest of the tree with small knives at intervals of from 5 to 15 inches; the milk, which flows for about an hour is collected in cocoanut shells, and boiled for about an hour which prevents it from

getting brittle. This gutta is exported usually in t
of oblong shape, with loops at their upper end, by wl
they are strung on to rattans, and so carried thro
the jungles. These balls weigh from 10 to 18 cat
and are of a greyish-colour outside, but dull red wit

The third kind, or *gutta-rambong*, Mr. Murton
scribes as more like caoutchouc or India-rubber.
fourth kind, *gutta-singgarip*, also partaking closel
the nature of caoutchouc. The last-named, *gu
sundek* or *putih*, being the produce of a variet
Dichopsis which differs in the form of its leaves f
D. gutta.

Many different kinds of figs (*ficus*) yield milk, an
considerable quantities. In Perak this gum is ca
gutta-burong, but appears to be little used except a
bird-lime for snaring birds.

CHAPTER XVI.

IRRIGATION.

In the Punjab there are three methods of irrigation: canal irrigation, well irrigation, and irrigation by inundation.

The spread of canal irrigation, which has been very great in the upper provinces of Northern India, is now considered by those learned in the irrigation question as rather a questionable blessing. For this reason, it increases the spread of "*Reh*." Those who have travelled through Northern India cannot fail to have noticed whole districts of land as white as if covered with snow, and entirely destitute of vegetation, not a blade of grass nor a shrub to be seen: this desolation is caused by *reh*, which is "a white flacculent efflorescence, formed of highly soluble sodium salts, which are found in almost every soil. Where the subsoil water-level is sufficiently near the surface the strong evaporating force of the sun's heat, aided by capillary attraction, draws to the surface of the ground the water holding these salts in solution, and these compel the water, which passes off in the form of vapour, to leave behind the salts it held as a white efflorescence." This is how the *usar* plains, which have existed for centuries in Northern India, were first formed. In many places the salts on the surface—the process having been going on all through the hot months—are quite deep, and the

ground is nothing but a bare white wilderness. The canals given to India under British rule are now said to increase this evil; and while they bring to the dry and barren tracts of land inundated by their means a flourishing and luxuriant vegetation for a time, before a few seasons have gone by *reh* makes its appearance, and the good done is quickly undone, "the last state of that land being worse than the first." Canals pass floods of water over the soil, and it gets thoroughly soaked, to say nothing of the percolation from the canal; this has in many places, formerly free from *reh*, now so raised the subsoil water-level that the water containing these injurious salts is brought within the action of the sun, and land which was once prolific and from which fine crops were obtained, is now covered with this white efflorescence and become barren.

This effect produced by canal irrigation has been observed for years along the banks of the older canals; but now it has spread very generally wherever such a method of irrigation is pursued, the result being an evil of rapidly spreading magnitude. In the North West Provinces in Oudh and the Punjab, where the soils contain a very large admixture of saline particles, the *reh* increases with marked rapidity, the ground each hot season becoming more and more overspread with its destructive covering. Along the Western Jumna Canal thousands of acres are so sterilised, and in the country irrigated by the Ganges Canal the enemy has made its appearance. If something is not speedily done to check the advances of *reh*, much of the land now yielding good crops must become barren wildernesses, devoid of even a blade of grass.

The evil is no slight one to grapple with, and committees on *reh* have been held to consider how best to counteract it, or rather to prevent it altogether. Sustained and careful cultivation may do something towards

arresting the evil; deep drainage and a re-alignment of the canals and their distributaries, so that they do not so much interfere with the natural drainage, will probably do more than tree-planting to arrest evaporation; draining by flushing the surface and subsoil, the raising of special crops, and more liberal manuring might all aid in the good cause; but that something must be done, and that something done quickly, none who know India will for a moment question. It may appear a hard task to war with so large an evil; but the longer that evil is allowed to spread—as it is now doing—the more difficult must the task become. We have improved upon nature, by denuding a dry land of trees, and flooding a country the soil of which abounds with salty particles with water, and then wonder at the result. Well irrigation is a very different affair. "Wells make little Paradises in deserts," as Mr. E. Elliott says, and if wells could be multiplied all over India, the native cultivator would not be in the state of poverty in which he is now too frequently found. Every fresh well sunk is a step gained; and if certain privileges were offered to those digging wells on their lands, their rents lessened or advances made during [illegible], a great deal of good might be done. Irrigation by canals can only be done on a larger scale, and then with very questionable results after the first beneficial effects of watering dry lands have worn off. But well-irrigation is applicable wherever water can be found at a reasonable depth. I have seen its [illegible] results [illegible] myself. A perfectly arid bit of ground, called, by courtesy a garden, which surrounded the [illegible], was, when we took it, a bit of [illegible] in [illegible], and in less than six months it became a mass of vegetation, and we had English grown peas at Christmas, though we had only gone into our new quarters in June, [illegible]

vegetables, grown chiefly from English seed, close hedges of gyte—a sort of quick-growing shrub like privet—masses of flowers, melons, and cucumbers growing in the greatest profusion, to say nothing of a small plot of maize which presented a perfect picture; and all this done with only one well, worked by one pair of bullocks, one on and one off, from the earliest dawn till darkness set in. This well was not one of the latest fashioned ones, but simply an old cumbrous affair, on the old Persian method, little chatties, working round a wheel and emptying their contents into a trough, as they came to the surface, the old familiar *dhail* plodding patiently round in a circle with its eyes blindfolded. I have heard since we left the station, that that garden has lapsed again into desert, the wheel in the well no longer creaks, and all is as bare and arid as when we first went there. The well process of invigorating land is slow compared to the canal system, but its results are certain, and far safer than a too rapid and continued soaking of the ground. If premiums in kind were held out by Government to tree-planters and well-diggers or sinkers, India would not be so famine ridden as she has been, and will be unless her interests in purely agricultural matters are better looked into. A well irrigates about 10 acres; but the work it does is, if the well be properly attended to, done thoroughly, and one great advantage is a supply of water is furnished throughout the year, that is if the wells are sunk to a proper depth. In Lower Bengal in the Sarun district a system of well irrigation has been quietly working for some years with the best results; the originator of the scheme was a sub-deputy opium agent, who took advantages of certain rules of his department, so says the *Pioneer*, to construct wells. During the last five years he has caused no less than 2,500 new masonry wells to be constructed, and repaired 300 old ones, at an average cost to the

poverty prevents any such work on their parts, unless a helping hand is stretched out towards them. Irrigation by inundation does not extend beyond river basins; but without doubt it is the safest and best of all kinds of irrigation, being the most natural it makes the summer crops almost a certainty, and if it last longer than usual brings on the winter crops also, though it too has it drawbacks, and sudden rises and floods often sweep away whole villages, sometimes entirely changing the aspect of the land it has swept over, and leaving behind it a scene of desolation and acres of sand; the ground, however, does not, as in the case of *reh*-covered land, lose its fruitful action, but in time becomes clothed with even a more luxuriant vegetation than it had before; the process of the restoration of the agricultural capabilities of the soil is in these cases gradual: first comes a thick growth of tamarisk on the new sandy surface; then this is cut for firewood, and ploughed fields take its place; ploughed fields turn into fields waving with rich crops; and thus to all intents and purposes new land exceeds in productiveness that the floods have washed away. So much for Nature's restoring processes, which we have tried to improve on.

Whatever system is pursued, canal, well, or the natural process,—irrigation furnishes employment for thousands of natives, be they employed on public works, as in the case of the construction of large canals, or in the labour of lifting water from wells and guiding it over the land in trenches, or in planting river sides, and taking up fresh land in sand deposits left by too rapidly rising rivers, they have at all seasons of the year work found them, and irrigation must be considered to them in the light of a gigantic industry, and one which is likely to continue increasing year by year. There is a move now in the right direction: earnest writers, men who know India well and understand her

needs, have taken up the matter. I can only wish such men God speed, and hope that they may by persistent effort, and unwearied importunity, gain for India what during our rule she has always, hitherto, wanted,—a well-regulated system of Agricultural Education. Until she has that, no lasting good will be really done. Irrigation, model farming, general farming, arboriculture, cattle rearing, including horse breeding—mining and general commercial industries—all need a fostering helping hand; and until that aid is thoroughly given, with no half-hearted, half-handed measures, the vast resources of our Eastern Empire will never be understood, or appreciated, or made as much of as they should be.

CHAPTER XVII.

IVORY.

THE best ivory comes from Africa, and is of closer texture and not so liable to turn colour as that brought from the East Indies. The Western and Eastern coasts of Africa, the Cape of Good Hope, India, Ceylon, and the countries to the east of the Malacca Straits, are the chief marts from which it is supplied.

The following is the quantity of unmanufactured ivory exported from British India in the last five years, at its estimated value:—

Years.	Quantity.	Value.
1874	5,936 lbs.	£2,295
1875	8,288 „	3,918
1876	12,300 „	5,947
1877	10,731 „	5,256
1878	11,211 „	5,665

Each male elephant, when arrived at maturity, has two tusks, hollow at the root, tapering off gradually towards the tip, and of various sizes; the colour outside yellow, sometimes quite dark brown, inside white. The best tusks are large, straight, and light in colour, and should be free from flaws, not too hollow in the stump, but hard and thick.

In trade the different classes are distinguished into first sort, second, third, fourth, and fifth sorts, the weight varying from 70 lbs. and upwards in the first sort to 18 or 21 lbs. in the fifth sort. Those tusks weighing less than 18 lbs. are termed "Scrivellos" and are of the least value.

The London ivory sales take place on the fourth Wednesday in January, April, July, and October.

Ivory is chiefly used in England for the handles of knives and billiard balls, and in the manufacture of musical and mathematical instruments, chessmen, toys, and plates for miniatures. The Chinese are the best and most delicate workers in this material, their ivory market is chiefly supplied from Malacca, Siam, and Sumatra.

Col. Pollok, in his "Sport in British Burmah," describes very particularly the elephants found in that country. He divides them into two varieties, *Goondas* and *Mucknahs*, the former possessing large trunks, that is the males, and the latter having none, or only rudimentary ones. These two kinds, he says, rarely herd together. The *mucknah* is styled tuskless, but it is not so in reality, as it has short sharp tusks like those of a walrus growing downwards, with which it can inflict very severe wounds. It is a fortunate thing that female elephants have only rudimentary tusks, or this noble species would have long ago been exterminated for the sake of the ivory.

In 1867 the imports of elephants' teeth amounted to 10,343 cwts. that is from all the various marts from which ivory was imported. The average weight of a tusk is about 60 lbs., so that this one year's importations would represent some 19,300 tusks, or the slaughter of about 9,500 male elephants. Some tusks are obtained by the natural deaths of the animal, and the shorter tusks are procured from the walrus and the *mucknah*

elephant. The tusks of the African elephant are much larger and of course weigh more than those of the Asiatic species. They grow in some cases very long, the growth increasing with age, the increase arising from circular layers of ivory growing from the core on which the tusk is formed. In some cases tusks measure from six to seven feet, sometimes as much as nine. The largest ever known was sold at Amsterdam, and weighed 350lbs., which seems fabulous. The tusks even of the Asiatic elephants are frequently so long that those of the domesticated animals have to be cut, otherwise they would become inconveniently long. The operation is performed with an ordinary saw kept wet by a trickling stream of water; sometimes in young animals, the tusk bleeds after the operation, in which case it is covered with some astringent adhesive salve, to prevent the flies attacking the place.

Ivory often becomes a yellowish brown from exposure to the air, but the colour can be restored by bleaching. Ivory can also be dyed nearly any colour, takes a good polish and admits of turning.

For the twelve months ending December 31st, 1879, 15,785 cwts. of elephants' teeth were imported, valued at £688,590; and in the corresponding period of 1879 9,312 cwts., value £392,943.

CHAPTER XVIII.

MINING INDUSTRIES.

COAL.

THE coal deposits of India are chiefly confined to a belt stretching from close to the Assam frontier south-west to Bombay, covering nearly five degrees of latitude. Towards Tenasserim this extensive basin becomes unpromising, and entirely disappears south of the Kistnah

Dr. Oldham, when he wrote his report on the Coal Deposits of India,—for he did not deny the fact that coal fields or basins, some of considerable extent, existed,—threw cold water on any Government scheme for its working, by speaking unfavourably of the quality of Indian coal, and also the quantity, which he did not think would prove sufficiently assured to justify any outlay of Government money being expended in working the different basins.

Happily for India, future investigations have proved that coal of very fair quality is to be found, and, fortunately for railway use, the most workable coal is near the Calcutta and Bombay lines ; for coal in Central India promises very fairly, and there are very many districts yet to be investigated of which report speaks highly. Most of the coal yet produced has been obtained from surface workings, and open quarries

The East Indian contractors used a good deal of this coal when constructing their lines, we are told; but the difficulty of carriage and the want of roads prevented the mines being further worked. Mr. T. W. H. Hughes has a paper in a recent number of the "Records of the Geographical Survey of India," on the statistics of coal importation, which is extremely interesting. He points out how much the annual consumption of coal for sea-going, and war-steamers, railways, factories, &c., has increased within the last few years, having grown to something between 900,000 and 1,000,000 tons, of which about one-half is foreign coal. That this should be the case, when coal is really to be obtained in the country itself, is a matter for deep regret; but why it is so, is because of the very heavy burden of charges imposed by land carriage and freights on the native product. The three chief coal-mining districts are Raneegunje, Karharbari, and the Wardha valley, and these are so situated that the coal by the time it reaches a port for shipment has its prime cost doubled and trebled by the railway transport alone. When the price of native coal is lowered by other lines of rail being opened, India will probably diminish her importation of the article very considerably. But until the price of transit is lowered by competition on different lines, this happy state cannot be expected to arrive; and the increase in the quantity of foreign coal brought into the Indian market will go on increasing. In 1853 the coal and coke shipments to India were 43,562 tons; now they reach 609,735 tons. Bombay is the largest consumer of imported coal. In Bengal a good deal of the coal of the country is used, especially the produce of the better seams of the Raneegunje and Karharbari fields. The coal industry in those districts has made during the last quarter of a century great advances, and now gives

employment to between 50,000 and 60,000 people, to say nothing of the families depending on these miners who have steady work in the fields. The "output" of the Indian collieries has been estimated at about a million tons each year, and probably this is no over statement, as the returns are mostly of the larger coal or steam raisings, the smaller rubbles and screenings being in very many instances not included, it being very difficult to arrive at any real estimate of the outturns from the Indian collieries as they are regulated in great measure by the orders they receive to execute. It is to be hoped, however, that better and more reliable statistics will be ere long available, as the Local Government is exerting itself on this head, and has called for returns from every colliery in Bengal: these returns if regularly given will supply the information respecting the labour employed, coal produced, general costs and so on. This industry is one which is most important to India's future, for the value of coal to her is yearly increasing, and must as she developes more and more, continue to increase in proportion. The railway alone will use up the greater portion of her native produce even if the mines give a larger out-turn than they do at present.

In Burmah coal has been found in various parts of good quality, but badly situated for working with regard to transit.

In Beraz, a very promising coal-field, interstratified with iron, has been quite recently opened. Mr. Cairn, in his "Notes by the Way in India," published in the *Nineteenth Century*, draws attention to them, and mentions that the iron was considered by Dr. Stenhouse to be as good as the best Swedish. A railway is proposed to open up this country, and connect its capital with the Godavery. This would be of immense advantage to this coal basin, as it would give it an outlet at both

ends. The nearest coal-field to Hyderabad by rail now being some 940 miles distant, and the proposed line would open a coal supply within 150 miles, which would be a great advantage to us, as well as to the Nizam. Bombay and Madras both draw their coal from England, or at all events their chief supply. Encouragement to coal-mining should be given all over India; in Bengal the increase of the collieries there afford employment to thousands of men, and help them to earn their own livelihood. "The development of Indian coal-fields and the cheap distribution of coal is, in the opinion of the Public Works Department of India, which in 1876 published a paper on the subject, one of the most important questions pressing on the attention of the Government, and no efforts should be spared to attain this object."

Proposals have lately been made by Lord Tweeddale's company to work the coal-fields of the Punjab. Coal mines in Bengal pay a small royalty to Government on the gross out-turn, and this company proposes that a concession should be granted to it extending over a hundred years, to work all the coal mines in the Punjab, "the would-be *concessionaires* paying a royalty on sales," the same terms being also conceded with regard to oil-springs. If this agreement is come to, the company will probably commence working the old mines near Pind Dadun Khan in the Salt Range. This coal was tested in a satisfactory manner in 1864.

Directly any decision is arrived at, that is if the concession be granted, a properly qualified mining engineer would be appointed by the company to examine all the likely localities between Mukkud and Dadun Khan; and if coal is found in large enough quantities to repay working, a fortune would not be very long in being recognized by the company; for the railway, which is so rapidly extending in Northern India, has a steady and

[illegible] demand for [illegible] on this line (S[illegible], Punjab and Delhi Railway) [illegible] said to amount to [illegible] tons [illegible]
[illegible] coal fields in Sind [illegible] which have never yet been [illegible] known to contain thick [illegible] coal. The coal-field of [illegible] district is only some fifty miles [illegible]. It is said to be 200 [illegible] contains good coal in seams of five [illegible] attempt was made to work this [illegible] the coal was sent down the [illegible] usual, the difficulties of [illegible] raised the cost of the [illegible] compete with the [illegible] Indian Railway. So it [illegible] death. A proposal has [illegible] Patna-Gya railway [illegible] is, however, to be [illegible] will be matured. If [illegible] increase in Central India [illegible] be hoped this may [illegible]

[illegible]

[illegible]an gold mining has [illegible] erable impetus. [illegible] Old workings [illegible] g, which prove [illegible] ch gold has been [illegible] eds of years ago. [illegible] workings by the [illegible]
[illegible]ia, even in Solomon [illegible] many people think [illegible] the port from which Solomon [illegible] of "gold, precious stones, [illegible]

and peacocks," as we read in the Bible, and even if Ophir was not in India, there is no reason why it should not be a shipping port for that country, in which case it might well have been in Arabia, as many writers suppose. That gold was found in India at a very early period is certain. Profane writers allude to it. Pliny and Herodotus, besides many others, indeed many of the so-called fresh discoveries of gold deposits to which attention has so lately been drawn, appear to be in very much the same spots history points to as containing the auriferous stone.

The old workings that have been found are mostly shallow; and probably though all the surface gold was removed by the natives in their primitive way, much gold yet remains to be found when deeper working is resorted to.

Since India has been a British possession, her mining industries have unfortunately been allowed to languish. As with coal and iron so with gold. Her richness as a mineral-producing country every age has borne witness to; but little has been done to develope and make the most of those riches.

The gold-mining in the south of India has, however, at present decidedly hopeful prospects; and Mr. Brough Smyth's reports on the "Wynaad Gold Fields," which from time to time are published, give every encouragement to the hope that there are palmy days coming for Indian gold-mining. The various reports are too lengthy to quote in full. But from them it will be found that at "Wright's Level," "Skull Reef," "Cavern Reef," the reefs in the neighbourhood of Devalah, Ettacul Reef and "Needle Rock," auriferous quartz has been found of different degrees of richness.

"The great thickness of many of the veins," Mr. Brough Smyth writes, "and the formation of the country which is such as to admit of the quartz being

mined economically, in deep shafts, no heavy expenses for the drainage of the mines being necessary, have to be taken into consideration when the number of reefs is looked at, and an estimate of the auriferous resources of the district has to be made."

The "Skull Reef" has a great thickness of quartz; in some places "it measures fourteen feet from the hanging wall to a mass of floating rock (country), but the total thickness has not yet been ascertained. This reef has been tested in five vertical sections, and the yields per ton of 2,240 lb. in each section are stated in the report (the fourth), the result showing that the stone in the fourth section gave a better yield than the others, and on this line being traced northwards along the strike stone was obtained which yielded at the rate of 1 oz. 4 dwt. 5 grs. per ton.

In these districts the remains of shallow works, before alluded to, made by native miners are found in many parts, it being evident that mining was extensively carried on at one time in the reefs themselves, and in the soils containing the *débris* and *detritus* of the reefs. At first the discoveries made by Mr. Brough Smyth did not attract much attention, but lately considerable enthusiasm has been expressed in various quarters on the subject of Indian gold; and not only has a commencement been made in the Wynaad, but a company is started, and it is said with the full capital subscribed, with the intention of opening up the Colar fields in Mysore. This company is composed of foreigners, report says Frenchmen, the *Crédit Foncier* of France, backed with enormous capital, at least so says the *South of Indian Observer* in drawing attention to the rumour. "The amount of five millions, guaranteed and set aside, has already been placed" (I quote from the above authority) "towards opening out the Wynaad, and they are in treaty, we believe, to buy up

the concession of the Colar concessioners. If it is true that foreigners have walked in while English capitalists were sleeping it serves us right. Many attempts have been made to push the thing in London, when either distrust or disinclination caused hesitation. The terms offered in London have been most liberal, and subject to fair test and trial before concluding a bargain. And now the time has slipped by."

The Alpha Gold Company has once more a prospect of recommencing mining operations; "arrangements have been made with the Foreign and Colonial Tunnelling and Prospecting Company, Limited, which has its head quarters in London. This company possesses patents, plant, and machinery, and a skilled technical staff and organization specially adapted for the working and development of mines." Under their auspices and arrangement this Alpha mine, which has hitherto been anything but a success, may possibly be got into paying and working order. The original shareholders started the mine with too little capital, and came to a standstill for want of necessary funds. This new formed company will start with a sum of at least £37,000. In Mr. Brough Smyth's report, respecting this mine, dated Feb. 18, 1879, the causes of its failure are clearly stated, mismanagement appearing to have nearly as much to do with its position as want of funds. The gold found in Wynaad is very fine, so fine that special machinery must be made to crush the quartz. It is for this reason that no "rush" to the Indian diggings has taken place on the part of gold miners; for the gold is not of the alluvial kind to attract the ordinary digger, whose sole capital is probably the pick he carries. To obtain the Indian gold in the quartz veins of the solid rock requires machinery, machinery requires capital to work it, and even given the machinery and the capital to keep it working much skill is required to

separate the gold from the pyrites with which it is found conjoined. Both Mr. Brough Smyth and Mr. Laing, who went to India to determine whether gold was really to be found there, are agreed, and have settled the question as to existence without room for a shadow of doubt. There is gold, rich gold, far richer they say than anything of the kind they ever saw in Australia (both being acquainted with that country and its gold regions); but they also agree with Mr. King in thinking that as far as regards alluvial deposit, the Wynaad prospects,—except on Vellera Mullah, which gives good indications of alluvial gold—are not so favourable or hopeful as the prospects of quartz-mining. India can never be a mining country in the same way Australia is, for the reason before stated, that to work quartz gold capital is a *sine quâ non*, and also because it is impossible to thoroughly prospect the country, because it is broken up into so many proprietorships. Rajahs, planters, and zemindars, all hold portions of the land, and being landowners consider their rights extend over the minerals found on their lands. Mr. Laing says, "India can never be like Australia, because there are no miners' rights." Men who make gold digging a profession, and gain by it their livelihood, will never go and prospect in a country where there are no mining regulations whatever. Government, people say, who are qualified to speak on the subject, has really no *bonâ fide* rights of property in the auriferous region; though vague rights will probably be asserted, which will open up the question as to its right to demand payment of ancient Malabar hereditary proprietors under the waste land rules, or ordinary ryots, in respect of gold found in their land. The Administrative Report for 1877-78 states that the Government is considering these questions, and the conditions on which leases should hereafter be granted,

or sales made of auriferous tracts of Government land." Of course Government will have to protect itself against loss if the Wynaad goldfields really succeed. As if people were attracted in anything like a rush, which is, for reasons before stated very unlikely, the expenses entailed by such proceeding would be considerable. Before decided steps are taken a distinct policy on the subject of mineral rights and royalty with reference to the peculiar condition of the Presidency, must be laid down. Permission to projectors to prospect over the assignment of a definite area, would doubtless be and has been given: while the final decision as to the terms of rent and royalty are pending: all this the report clearly states, as also "that the Government of India have determined to appoint a competent mining engineer to examine into the whole question of mining in Southern India." Landowners will naturally do all in their power to keep the working of the Wynaad goldfields as much as possible in their own hands, and prevent the development of the auriferous tract of land over which they have private interest by any outsiders, arguing, no doubt, that the mining rights are theirs already. But it will be a difficult task to raise capital to privately work Indian mines, and the fact of companies having already been formed is enough to show that private capital was not forthcoming for the venture. The working of mines in India would be a more difficult undertaking than to work mines in other countries; the want of skilled labour would prove at first a serious obstacle, and though by collecting such labour from afar the work might proceed fairly well, the expenses entailed by such a system would very materially lessen the gain. The gold-mining industry as it progresses, and now it seems in a fair way to do so, must become a less particular and more general source of benefit; and it is just this which at first led the land proprietors to

hold out against foreign capital, and endeavour to throw cold water on the speculation. But to work Indian gold mines capital must be forthcoming, and if private enterprise could not furnish sufficient, foreign capitalists naturally stepped in.

Whether foreign or country money is embarked, the result to India can only be a good one. More labour for her huge population, consequently a better livelihood for them, and less dread of poverty and ruin, and a a general stimulus to trade which must directly or indirectly affect the whole Empire, increasing her trade and consequently her prosperity.

IRON.

There are abundant stores of iron in India, which till of comparatively recent date have been much neglected; but which only need capital to prove even more valuable than the working of the auriferous stone of which we now hear so much. (See "GOLD.")

Capitalists alone, however, are likely to make the utilisation of Indian iron works really pay. And it is to be hoped that the Government of Bengal will be able to render some substantial aid to the "Bengal Iron Company," and encouraging it by such aid establish its position in the commercial world beyond any possibility of doubt.

It is a notorious fact that India's iron trade is, considering what vast beds she has of iron ore, in a state most discreditable to the administration of the empire.

Iron is found in many parts of India; large deposits have been discovered in the Central Provinces, Simla Hill estates, in the Nerbudda Valley, in Kumaon, Bundelkund, Berar, Salem, Chandar. In Salem, Mr. Blandford states, the supply capable of being obtained from the beds there is almost inexhaustible, the beds

are from 50 to 100 feet thick, the outcrop of which may be traced for a long distance: "One forming the ridge of a hill 1,500 feet high and four miles long, and another place he mentions, near Salem, where there are five bands of magnetic iron from 20 to 50 feet in thickness, which run round a hill four miles long. The Lohara, near Chandar, iron-ore is said to be almost pure, yielding to assay 70 per cent. of metallic iron.

A writer in the *Indian Agriculturist*, in writing of the Simla iron, says it is found chiefly in the "British tahsil of Kotekhaie, and the native states of Bissahir and Jubal. In Kotekhaie the mines are situated on two different mountain spurs close to each other. The first, known as Moltann, is near the village of Trola. The second, called Tumbaran, is at the foot of the village of Degwari Jubal. This iron is procured in grains, like sand, from a micareous schistose matrix, thickly encrusted with small imperfect garnets. The ores yield magnetic oxide of iron as follows:—

Moltann	19·33 per cent.
Tumbaran	28·47 "

This difference, though, does notprove that the latter is richer than the former, but more likely is owing to the variableness of the specimens. The iron is smelted in April to May, after the snow is melted; and again from September to October. These mines are worked by running a horizontal shaft, only three and a half feet in diameter, into the side of the mountain. The schistose matrix, containing the iron grains, is brought out in skins, reduced to a fine powder, washed in the stream and the grains of iron smelted. When reduced to small pigs, it is again put into the fire and hammered until it becomes malleable. All these processes are performed on the spot. The furnaces are nothing more than large clay crucibles, about three feet high, not unlike cones,

the diameter in the centre being about [illegible]. There are two holes at the bottom for the [illegible] of the nozzles of two bellows. The crucible being placed over an ash hole is filled with grains of ore [illegible], fire applied, and the bellows worked. When sufficiently fused an iron rod is struck through the bottom of the crucible, upon the withdrawal of which the impurities run into the ashpit, leaving the iron in the crucible."

This extract gives a very good idea of the primitive manner in which native miners and smelters work.

A short distance from this mine are those of [illegible] in the native territory of [illegible]. Here the ore occurs in talcy schists, it is worked and manufactured in precisely the same way as already described.

It is estimated that about 2,000 maunds, reckoning 80 lbs. to the maund, of iron are sent annually from these mines, to Simla and the plains, also to Thibet viâ Rampore.

In the native territory of the Rana of Jubal iron is found in three hills, named respectively Jadholi, Pronti, and Panasi. They yield magnetic oxide of iron in the following proportions:—

Jadholi	[illegible] per cent.
Pronti	[illegible]
Panasi	[illegible]

It is considered that to obtain one maund of pig iron, two maunds of charcoal are necessary to produce it. In manufacture, therefore, the 2,000 maunds of pig iron said to be produced from these annually, some 4,000 maunds of charcoal would be required, which would represent at least 20,000 maunds of wood, equal to 2,000 trees. At this rate the work of denuding the forests is going on, without any attempt being made to reboise them. There being little or no forest supervision around Kotekhaie this destruction of trees goes

on without any proper discrimination, which with a resident European forest official would not be the case, as the trees would be thinned with greater care. That there is plenty of iron to be obtained from these districts for the trouble of working is certain, only skilled European superintendence is required to make the most of it.

In Gwalior, too, there is much iron ore found and of good quality; in this territory between Lushkur and Seepree there is an unbroken bed of brown hematite, which is the richest ore in the world. The bed extends nearly 60 miles, and the ore yields 75 per cent., even under the unskilled methods of native working. Charcoal is the fuel employed here also by the natives. Under a better system this iron would undoubtedly be the best produced in India. Even native workers in iron prefer it to that obtained from any other district.

The Maharajah Scindia has frequently had his attention drawn to the extreme richness of his territory in iron-ore, and from time to time has stated his intention of working it himself. A native's idea of time is, however, very vague; *to-morrow*, being the time usually fixed for commencing any undertaking,—the *to-morrow* for that particular business never arriving. Once Scindia really did advance money to an outside adventurer to begin to work his iron-mines; but the money appears to have been wasted, and the workings abandoned, or rather never properly commenced. The real wealth that would accrue to the Maharajah of Gwalior, if the iron mines in his dominions were really properly worked, can scarcely be over estimated, or the good such an undertaking would do to the people not only in Gwalior, but all over India.

Every year India feels more and more the want of her natural mineral resources being more generally opened up. She wants iron, malleable iron; and as her

want for machinery increases so does she feel her helplessness without a good home manufacture of iron. Having to send to England for machinery, or even for the necessary repairs to machinery, is scarcely the way to facilitate her trade.

The national supply of iron in India is unlimited, and yet this mineral wealth is productive of little real good to the country. The iron trade, instead of advancing as it should in India, is decreasing, because the supply of wood for charcoal has already been heavily drawn upon, and the forests are not what they were in the iron district, vacancies not being filled up by planting as they ought to have been, and should be. If the iron-trade is to be established the coal-trade, which may almost be said to be a part of it, must be encouraged also. The presence of iron is a sure indication that coal will be found not far off; and when coal is touched it is equally certain that the district in which it is found is more or less ferruginous. But the fact that this is so, and knowing how much India contains of both valuable minerals only increases the astonishment at the apathy of the Government towards developing them, and with their development rapidly increasing the wealth and power of our Indian Empire. Some pig iron from Barraker has been forwarded to Woolwich to be tested as to its suitability for conversion into steel, with what result, however, is not yet known.

In the Wardah district iron-ore, limestone, and coal are all found, and from them an iron sponge is obtained by the direct process of reduction. This sponge, when melted with charcoal in proper quantities, yields a steel of the very finest quality. This process is a great scientific improvement on the old system of "first producing cast iron, and then converting it into malleable iron by puddling;" but as to saying that this new

process to perfection new furnaces of peculiar construction are required, it will be some time, in India, before the new system can compete with the older and more laborious one.

At Wardah, though the iron-ore is of the best, the limestone and coal both good, the results so far have not been so successful as those of the "Bengal Iron Works Company," though they have to contend with inferior ore to that obtained in the Central Provinces. In a recent report of this company it is stated "that the output of the first furnace belonging to the company increased from 863 tons in the first half of 1876 to 3,577 tons in the first half of 1878, and that the demand for casting has grown so rapidly that the foundries are now able to use up all the produce of this furnace. The company, though apparently flourishing, is not yet in a position to pay a dividend, having rather difficulty in obtaining money to extend the works, as it is necessary they should be by erecting puddling furnaces and rolling mills.

Petroleum, see "OILS."

PRECIOUS STONES.

DIAMONDS.

This valuable stone has been known from the remotest ages. India has been especially prolific in these gems, her diamond mines having long been famous, more so in ancient days than at this present time.

From Pannah or Purnah, supposed to be the Panassa of Ptolemy, the capital of the diamond district, the Emperor Acbar is said to have drawn eight lakhs of rupees annually. Pannah is in the Bundelcund district of Allahabad, and it stands on a rocky plain above the Ghauts. It has numerous temples, in one of which

is an idol with a diamond eye of great value and wonderful brilliancy. For miles around Pannah the soil, which is a red gravelly one, contains diamonds, which are generally found at three or four feet below the surface. The soil is in some places red, in others brown, and where the diamonds are found is full of small pebbles.

The diamonds are of the table kind, and they are not often found perfect, nor yet of large size, being generally about the size of a pea, but others are now and then found as large as hedge nuts. When Acbar drew so much money from these mines, they were in their prime, as recently though as the middle of the last century under Rajah Chuttersal the Government profits from them amounted to four lakhs of rupees per annum. The workmen employed on them were mostly rajpoots, and as many as a thousand were employed; they gave it as their belief, founded on experience that the generation of the stone there was perpetual, but that it took a period of from fourteen to sixteen years for nature to complete the process of the formation of diamonds; and they declared that they had as much chance of finding these gems in earth which had been worked so many years before as if they turned up fresh soil.

These mines have now very much declined, indeed they seem quite exhausted, which rather does away with the rajpoots' theory of perpetual generation. The mine of Sumbhulpore on the banks of the Mahanuddy (the Adamas of the ancients) in Gundwana, was a rich one, and is reported to abound in small diamonds even now. After the rains a red clay is washed down from the mountains, and diamonds have been frequently found in it. In the 17th century the diamond mines of Zedhout in the Balaghaut ceded territories were justly famed. These stones have also been found about forty miles north west of the junction of the Beemah and

Krishna rivers; also at Colore, on the southern bank of the Krishna near Condavir; and many parts of Golconda have at different times been prolific in these stones.

Most Indian mines now, however, are of but little value, compared to what they once were, though they are still found here and there; in Sumbhulpore, for example, where the diamond-washing trade is hereditary in particular families. The lustre of the Indian diamond is greater than that of the Brazilian, and the stones which were found in years gone by are brighter and of greater value than those now from time to time found.

SAPPHIRES.

These stones are also found in India, but more frequently in Ceylon and Burmah. They rank next to diamonds in value. The red sapphire, or Oriental ruby, is not found in any considerable quantities anywhere except in Ava. From time to time sapphires have been found in India, but not to any great extent. Burmah exports annually great numbers to England and the continent, but they do not equal the stones found in Ceylon, being lacking in light and colour, and looking at night almost black. In Siam lately valuable sapphire mines have been discovered, and a rush of Burmans and Shans to them has taken place, many valuable gems having already been found and sold for good prices.

AMETHYSTS.

These precious stones are found in India and Ceylon, besides many other places. The oriental amethyst, Mr. Emanuel says in his "Diamonds and Precious Stones," is really a ruby or sapphire, possessing an amethyst colour, which may be distinguished from the ordinary

stone by its [illegible] its hardness. [illegible] comparatively [illegible] found.

[illegible]

These are a [illegible] a high [illegible] principality of [illegible] far from [illegible] beads, crosses, [illegible] to other parts [illegible] and the [illegible] the very [illegible] the city [illegible] also worked [illegible] agate mines [illegible] very wild j[illegible] worked. H[illegible] shafts, w[illegible] wide; the [illegible] chiefly of [illegible] On the [illegible] olive colour, [illegible] lighter, and [illegible] but it is [illegible] assume after they [illegible] ing. On [illegible] exposed to the [illegible] they remain in that [illegible] will be the [illegible] stituted for [illegible] stones very [illegible] lustre. After [illegible] boiled for two [illegible] turers to be cut and p[illegible]

hues; those called cornelians are black, white, and red, in shades from the palest yellow to the deepest scarlet.

TURQUOISE.

The Indian turquoise is held in high estimation. The stones appear to be very frequently found, as many natives wear them as ornaments. Near Mooltan a great number are found, and very fine stones I have seen in that neighbourhood worn by natives. My ayah wore a very large one let in to the bone of her nose. It is wonderful what very good gems you often see worn by quite low caste natives, only they are generally so roughly and commonly set. I have seen fine rubies, turquoise, crystals, and even diamonds, amethysts, and emeralds worn by native servants. They put all their money into silver or precious stones, and wear them constantly on their persons.

There are turquoise mines in Persia, which I believe are the only mines said to furnish real turquoise; but I have had some very fine stones shown me which were said to have been found in the Punjab.

ONYX.

The Indian onyx, which is supposed to have been the *shoham* of the Jewish high-priests, was found in a chain of mountains corresponding to those called the Balaghaut hill. These stones are really a species of quartz, and are composed of flat layers or bands of chalcedony, of different colours, usually brown and white and are often used for cameos.

LAPIS LAZULI.

Some writers consider this stone to have been the sapphire of the ancients. It is found in many parts of

India, in the mountains of [illegible] and also in the range in the north-west of India. Many of the high class temples are ornamented with it, both inside and outside, but in too many instances these stones have been ruthlessly dug out by tourists, and the tombs and monuments robbed of the gems with which they were formerly adorned.

GARNETS

Are very commonly met with all over India, especially in places where iron abounds.

PEARLS.

The Ceylon pearls must be mentioned, though perhaps they can hardly be considered as an Indian industry. Pearls are, however, frequently found on the Indian coast, at Tuticoreen in the province of Tinnevelly, on the Coromandel coast, and in other places. But the Ceylon pearls bear off the palm, and are the most valued in England. A necklace of Ceylon pearls smaller than a large pea is worth, so Mr. M[illegible] says, from £[illegible] to £300; one with pearls the size of [illegible], from £15 to £20, the larger pearls being [illegible] a guinea each and the smaller from 2s. [illegible] pearls, are not of much value, though [illegible] by the natives as trimmings. The largest [illegible] seen in Europe bore the name of [illegible] incomparable. Its weight is stated at [illegible] is pear-shaped. It was brought from India by [illegible]bus of Calais. It was shown to the [illegible] it belonged to Philip IV., King of Spain, who is reported to have asked the man, "How [illegible] your whole fortune upon so small a thing?" [illegible] merchant replied, "Because I knew that there [illegible] a King of Spain who would buy it of me." The pearl

is now in the possession of Princess Youssopoff, and is valued at 80,000 ducats.

Numbers of natives are employed in these Indian and Ceylonese pearl fisheries, and a great many who work on the Ceylon banks really belong to the Coromandel coast, and to Tuticoreen. Many of the divers are almost black, and are Marwas and Parawas. The Bay of Condatchy is the usual place of meeting for the boats employed in the pearl-fishing. The season generally commences in February and ends in April. Each boat carries about twenty men, one half at least of the number being divers. In "Percival's Ceylon" will be found a very good description of their methods of collecting the oysters. The divers are paid differently, according to the private agreements they make with the owners of the boats, either in money, or with a proportion of the oysters caught, which they take the chance of opening on their own account.

The oysters when brought on shore are placed in holes dug in the ground, about two feet deep, or else in squares fenced round to mark the property of the different boats. The oysters are placed on mats, as they must not touch the earth, and then they are left to rot, when they have passed through the stage of decay and are dry, they can very easily be opened. They are carefully examined and generally boiled, as the pearls are sometimes found in the body of the fish itself.

The natives are wonderfully clever in preparing the pearls, drilling and stringing them. Captain Percival thus describes the machine which is used in drilling, it is made of wood and of a shape resembling an obtuse inverted cone, about six inches in length and four in breadth, is supported upon three feet each twelve inches long. In the upper flat surface of this machine, holes or pits are formed to receive the larger pearls, the

smaller ones being beaten in with a little wooden hammer. The drilling instruments are spindles of various sizes, according to that of the pearls; they are turned round in a wooden head by means of a bow handle to which they are attached. The pearls being placed in the pits, before mentioned, and the point of the spindle adjusted to them, the workman presses on the wooden head of the machine with his left hand, while his right is employed in turning round the bow handle. During the process of drilling, he occasionally moistens the pearl by dipping the little finger of his right hand in a cocoa-nut shell filled with water, which is placed by him for that purpose; this he does with a dexterity and quickness, which scarcely impedes the operation, and can only be acquired by much practice.

There are other instruments also for cutting and drilling besides the one described, and the pearls are cleaned, rounded, and polished with a powder made of the pearls themselves.

The Tuticoreen pearl-fishery is monopolised by the Indian Government; and that of Ceylon by the Colonial Government. Bombay is the chief pearl market in the East, and the pearls from the Persian Gulf are sent there in great numbers for sale. But other precious stones, particularly diamonds, are very plentiful, and emeralds, sapphires, agates which are sent here from all parts of India to be disposed of. There are over [illegible] jewellers and dealers in precious stones in Bombay alone. Wealthy natives are the chief purchasers of these various gems, and are very good judges of valuable stones. To English eyes, the natives ruin their jewels by having them so frequently drilled and strung, which spoils the brilliancy of the stone.

The actual proceeds of this year's pearl fishery in Ceylon were considerably greater than had been anticipated. Seven millions of oysters were [illegible], [illegible]

of about three millions; and had the weather not been such as to interrupt the divers it is probable that even two millions more might have been lifted. The sales realized about 60,000 rupees; and it is said the pearls in the possession of Government are worth at least 40,000 rupees.

JADE.

A considerable trade is done in jade stones, the exports of which for the last five years have been as follows:—

Year.	Cwt.
1874	2.495
1875	5,153
1876	2,341
1877	4,076
1878	3,565

CORAL

Is procured from the West Coast of Sumatra, from Singapore and India; but not in very large quantities, neither are the exports of much note.

SALT.

This necessary article forms, as my readers are doubtless aware, a very important branch of Indian commerce, and is one of the three chief sources of Indian revenue.

The tax on it is the only one which directly affects the lower classes of the population; but the recent reduction in the rates of salt duty in the Bengal Presidency, and the new arrangements respecting the taxing of Rajputana salt, will relieve our Indian subjects to the extent of at least 16 per cent. of the old rate without

any material loss, on the contrary a decided gain to the revenue.

In glancing back to the earlier rules and regulations of the Indian salt trade it will be found that even under the Mahomedian rule a tax was levied on the salt consumed by the people of Bengal, by means of imposts on the privilege of manufacture, and the duties levied on the transportation of the article from the places where it was procurable to the interior of the country. In the early years of the East India Company's Government in Bengal a monopoly of the salt trade was established for the benefit chiefly of the Company's servants. This system was, however, of short duration, as it did not come under the approval of the Directors of the Company. In 1772 the manufacture and wholesale trade of salt were farmed out to individuals, and thus converted into a considerable source of revenue to the Bengal Government. A few years afterwards Mr. Hastings introduced a plan of obtaining a supply of this article by means of the agency of the Company's civil servants; and this system has with various modifications and alterations continued until the present time. For the first thirteen years of the agency system the salt was sold at fixed prices regulated by Government; then, in 1788, Lord Cornwallis adopted a plan of selling the monopoly of salt by public auction, this practice continuing until 1836, when the older plan of fixed prices was again resorted to. The chief supplies, in those days, came from agencies in the districts of Chittagong, Jessore, Tumlook, Hidgelee, and the Cuttack province.

Indian salt is obtained from mines in the ordinary way, and from lakes by the process of evaporation.

The whole country of India, from Jhelum to the Afghan frontier, is full of salt, and is constantly mentioned by English writers from comparatively early times. Elphinstone and Burnes both describe the

Indian salt regions, the former having passed, on his way to Cabul, through a very narrow road cut through a solid clear salt rock at Kalabagh on the Indus. Valuable salt mines being situated both at the place named and in Kohat. Wood, Jameson, Fleming, and Strachey, besides many others, have much to say on the subject; and quite recently Mr. Wynne, of the Geological Survey, has published a work on the physical geography and geology of the Salt Range, which is replete with valuable information; he shows clearly that the age of the Punjâb salt is anterior to that of the oldest fossiliferous rocks by the discovery of Lower Silurian fossils in overlying beds, earlier writers than Wynne fancying because the Punjâb salt was associated with red marls that it belonged to the same geological formation as that found in Cheshire and Worcestershire, that is the New Red Sandstone or Trias.

The Punjâb salt-range is an extensive range rising in the form of a bold escarpment from the plains to the height of 2,500 or 3,000 feet in the highest part, crossing the barren Sind Sagar Doab, and stretching from the eastern base of the Suliman mountains to the river Jhelum, the deep valley of this river and the Indus cutting through the eastern and western ends of the ridge. The salt mines in this range have long been known and worked, being mentioned even in the Ageen Akbery, and they were well worked and productive in the reign of Akbar, from the immense quantities of salt annually raised from them they appear to be inexhaustible; the beds in many places being of astonishing thickness.

Maharajah Golab Singh farmed these mines during the period of the Sikh rule. Latterly the salt department under the Government of India have worked the mines, and during these excavations repeatedly come on the old Sikh workings, which are very extensive and in many places dangerous to the miners, as they cause

frequent falls of the roof, the modern workings are carefully arranged in "pillar and stall;" but even in these "many of the openings are very large, the beds of salt being sometimes more than 100 feet thick." The salt obtained from these mines is hard, clear, and almost pure, were it not for the red streaks which are to be found here and there.

Lake salt just now, however, appears to be even more thought of than rock salt. The Sambhur Lake, in the province of Rajputana, is some twenty-two miles in length from east to west, six miles in breadth and fifty in circuit; but it varies in its dimensions, as in times of extreme moisture it extends to nearly thirty miles in length and ten in breadth. In the hot weather its waters evaporate, and an immense deposit of crystallized salt is found at the bottom of the lake. This is collected, and after undergoing a hardening process in the sun, loses the reddish hue it at first has, and becomes perfectly pure and of excellent flavour. The greater portion of this lake belongs to the Jeypore province, the remainder to the Joudpore estate. There is a similar, but larger lake in the province of Cuttack called Chilka Jhil (lake). It is very shallow but extensive; forty-two miles in length from north-east to south-west and sixteen in breadth, and has a narrow channel communicating with the sea; it too yields a very large quantity of salt—culinary salt chiefly—by the same process of evaporation. Formerly in the collection of the salt duty coming from both the Rajputana Lake and the salt mines a Customs line of over 2,274 miles was maintained, nearly 12,000 men, including officers, being employed on it, their salaries and wages amounting to £162,000 yearly. Recently this old Customs line, which extended from Attock to Cuttack with the exception of the Trans-Indus section of it has been abolished, or will be by the 1st of April next. The

Trans-Indus portion of it is maintained at a cost of £6,600 per annum, to prevent the nominally taxed Kohat salt, which is sold to border tribes, from being brought back into British territory.

Lord Mayo was the one to initiate this reform in the salt administration, which he commenced in 1869. The Government now rent five new salt sources in Rajputana, the yearly payment for them being £38,700. By this arrangement the native states gain £143,000 yearly in compensation for the abolition of the transit duties, and Government loses £48,000, which, however, will doubtless be recovered in the increased consumption of the article.

The salt revenue collected by the Inland Customs department is derived chiefly from the duty on the salt consumed in the Punjâb, N. W. P. Oude, and a small portion of the Central Provinces, which get most of their salt from the sea coast. This coast salt pays duty in Madras, Bombay, and Orissa. The excise duty of 2-8 rupees per maund is now imposed on all salt, Bombay paying 2-14 rupees per maund, and some native States which have their salt duty free being the exceptions to the general equalization of the salt duty which has been effected throughout India. "Bombay and Madras pay 12 annas more than the fixed rate of 2-8, and Bengal 6 annas less; Upper India 8 annas less, and Sindh one rupee more. The effect of this on consumption is that in Northern India there is an increase of 14 per cent., and a steady increase in Bengal, though in Madras, Bombay and the Central Provinces there is a decrease during the present year of 3 per cent."

The total quantities of salt which paid duty in the Inland Customs Department in the first half of the financial year 1879-80 was 2,293,576 maunds, against 1,815,246 maunds in the first half of 1878-79. This

does not include the Trans-Indus and Mandi salt, most of the duty paying salt being brought from the Sambhur Lake, where it is prepared and sold on Government's behalf. The out-turn of the Punjâb salt mines was reckoned at over six lakhs of maunds. About three lakhs of maunds were produced from the Gurgaon private salt works, and the new sources in Rajputana gave about one and a half lakhs. Taking India as a whole, the consumption of salt in 1867-68 was 22,750,000 maunds, and in 1878-79 24,200,000 maunds. The net salt revenue of the empire having increased within the last ten years to the amount of £1,201,000. Purchasers of salt used to be provided on purchase with what was called a *char* and a *rowannah*, the former being a document which on presentation at the place of store secured the delivery of the salt specified therein, and the latter was a protective pass serving to cover the salt during its transit through the line of preventive officers whose stations intervened between the Agency's districts and the interior of Bengal. This system has now been partially abolished with the abolition of the Customs line. In Madras the salt sale and manufacture are in the hands of Government, who contract for the quantity required for the year.

In Bombay the excise system has been in force since 1837, the manufacturers taking out licences to open works. The falling off of the salt paying duty in the early part of 1878, due in part to the recent reduction of the duties, of course reduced the revenue, but also to the reluctance on the salt traders' parts to bring salt paying the lower duty in the markets while they had stocks still on hand, on which they had paid the higher rate of duty to dispose of. If they adopted such a policy they laid themselves open to competition with other capitalists, who had purchased at cheaper

rates, and so could afford to undersell them. In India, however, trade does not pass with such rapidity into new hands as it does with us; and outside capitalists speculating and "plunging" in salt against the old regular traders would be apt, as the monkey did when handling the hot chestnuts, to burn their own paws. The salt supply was kept down by the old hands, and the prices kept up to the old level, reduction notwithstanding. Not that such a state could last after the old high-priced stock had been disposed of; and the reaction has long since set in, as may be seen from the following table given in a recent number of the *Pioneer Mail*, which is a comparative statement of the entire Indian salt tax for the first six months of the present and four previous financial years.

Year.	Quantity of Salt taxed in maunds of 82 2-7 lbs.	Duty levied,
	Maunds.	Rupees.
1875–76	11,343,393	2,79,19,833
1876–77	11,066,063	2,73,74,322
1877–78	12,040,098	3,00,93,066
1878–79	11,402,397	3,01,67,817
1879–80	12,545,124	3,18,34,915

In considering these figures the following facts must be borne in mind. During the first three years the duties were levied at the following rates per maund: Lower Provinces, Bengal, rs. 3-4; Upper Provinces Bengal, rs. 3. Bombay and Madras, rs. 1-13. In 1878-9 the rates were, in Lower Provinces, Bengal, rs. 3-2; Upper Provinces, Bengal, rs. 2-12. Bombay and Madras, rs. 2-8. In the current year the rates are in Lower Provinces, Bengal, rs. 2-14; Upper Provinces, Bengal, Bombay, and Madras rs. 2-8. Thus the tax has

been lowered [illegible]
Presidency, [illegible]
Presidencies; [illegible]
except, as [illegible]
Bengal, [illegible]
maund that [illegible]
show that [illegible]
salt tax has [illegible]
while the [illegible]
siderably [illegible]
ments made [illegible]
taxing the salt [illegible]
a fair way [illegible]
in the [illegible]
"Imperial [illegible]
even mentioned [illegible]
pos of the salt [illegible]
The Government [illegible]
ment with [illegible]
year he was [illegible]
The Viceroy [illegible]
said, taking [illegible]
there is anything [illegible]
it." "There [illegible]
"Please [illegible]
Sambhur salt [illegible]
the Rajputana [illegible]
quately supplied [illegible]
trade in it, [illegible]
transported from [illegible]
maunds frequently [illegible]
conveyance, railway [illegible]
not wagons enough [illegible]
purchasers naturally [illegible]
hoped that in the interest [illegible]
stock of the Rajputana State Railway [illegible]

siderably increased, and no check given to the extending trade, or the impetus it has received by the reduction in the duty may be materially damaged.

COPPER

Is found in many parts of India, and remains of ancient copper mines are frequently found. Landu was formerly one of the chief localities where copper-mining was carried on; the little village of Rajdoha was at one time almost given up to copper works, furnaces, and smelting houses, and the deserted buildings and an engine were still to be seen there when the geologist Mr. V. Ball last visited the spot. At one time he says there must have been upwards of twenty distinct mines in this one district. In Singhbhoom traces of ancient copper mines are also to be found. Now the Daruba, Puttiala and Nellore copper mines are the best known; and specimens of good ore have been obtained from Hurladi in Palgunj, where "there is a mineral lode in which copper, lead, and zinc ores all occur;" and some of the specimens obtained from it by Mr. Ball he considers more promising than any he had previously met with in Bengal. Copper is also found in Dholbhoom, Maunbhoom, Deogurgh, Beerbhoom, Ramigunj, in Bengal, in Nepaul, Kumaon, and other places.

TIN

Is found in considerable quantities in the districts of Hazaribagh in British Burmah and in the Karen Hills Tinstone (stream tin) has also been discovered in Burmah, in Hewzia Bay, Moulmein, in the Kahan Hills near Mergie, in the Tenasserim Provinces, in Tavoy, and in the Malay Peninsula.

LEAD (Galena)

Comes from Deogurgh, Beerbhoom; Chota Nagpore, Nepaul, Puttiala and Subathoo mines, from Ulwar Rajpootana, Chichola, where there is a lode containing both galena and copper ores, but unworked though known to exist; in Dhadka also a valuable lodge of alena has been discovered though no steps have been taken to profit by it; neither by the lode which is also known to be valuable in Sambalpur. Lead is also found in Madras, Assam, and Burmah.

CHROMIUM (Chromite)

Has been discovered in Salem and Haule Ladak.

MANGANESE (Psilomelane)

Is brought from Tenasserim.

ANTIMONY (Stibnite)

From Ava, Moulmein, Lahoul, and is said to have been found in a pure state on the shore in Straits Settlements.

Amongst the miscellaneous minerals found in the country, I may mention gypsum, potash, sulphur, mica, selenite, graphite, corundum, calderite, lepidolite, piase, limestone, gritstone, soapstone, various sands, sandstone, quartzite of different colours, calcspar, slate from the Monghyr slate quarries which are noted—shale, basalt and chert.

CHAPTER XIX.

OILS.

CASTOR-OIL.

In the trade in Indian oils, castor-oil, or the produce of the *Ricinus communis*, is of great importance, and figures highly in the oil exports.

There are two kinds of castor-oil plant cultivated in the country, *R. fructibus majoribus*, and *R. minoribus*, the real castor-oil being obtained from the latter, while the oil produced by the former is chiefly used for lamps and lubricating purposes. This plant was known in very early ages, the Egyptians and Greeks both being acquainted with it, the Greeks calling it *croton*, and the Egyptians *kiki*. The word is derived from the Latin name *ricinus* of an insect, to which the fruit of the plant is said to bear a strong resemblance. The plant is also known by the name of *Palma Christi*. It is generally supposed to be a native of Barbary; but it is now naturalized in Asia, Africa, America, and in the southern portions of Europe. There are several varieties of the genus of plant belonging to the natural order of Euphorbiaceæ, but the one under notice is the best known of them all. The plant itself is very handsome, and much valued by amateurs as a foliage plant. I brought many seeds of it home with me from India,

and succeeded in rearing in a hot-bed without any difficulty some fine plants. In tropical countries the castor-oil plant is a perennial, but in colder climates only an annual or biennial. It has peltate, palmate leaves, with their lobes serrated, the stem is herbaceous and glaucous, of a beautiful purplish red colour, the flowers spring from the divisions of the branches, "the males from the lower part of the spike, the females from the upper." The capsules are covered with prickles, and the seeds are shining, oval, sometimes quite black or else spotted with grey. It flowers the greater portion of the year in India. A species of silkworm moth, the *Attacus Cynthia*, feeds on the leaves, so besides being cultivated for the sake of the oil the seeds contain, the *Ricinus communis* is also reared for food for silkworms, and, as the wild moth which feeds on it becomes more domesticated—as there is but little doubt that it will—these castor-oil plants will be even more cultivated by natives than they are at present. Formerly in extracting the oil from the seeds much heat was brought to bear on them. Now this is altered, and the process was really not in the least necessary. Sir William Ainslie writes in the *Materia Indica*, vol. i., p. 256, on the plan pursued in the East Indies for extracting the oil:—"Take five seeds of the small castor-oil nuts, and soak them for one night in cold water; next morning strain this water off and throw it away, put the nuts in a second quantity of fresh water and boil them in it for two hours, after which strain the water off and throw it away. The nuts are then to be dried in the sun and on a mat for three days, at the end of which time they are to be well bruised in a mortar; add to the nuts just bruised ten measures of water, and set the whole on the fire to boil, taking care to keep continually stirring the contents of the pot until all the oil appears at the top, when it is to be carefully strained off and bottled for use. The quan-

tity of nuts mentioned in this formula ought to yield about one quart bottle of oil."

There are many other methods of preparing the oil, and this may be cited as a newer process than the above, it being given in the report of the juries on the fixed vegetable oils sent to the Madras Exhibition:—"The fresh seeds, after having been sifted and cleaned from dust, stones, and extraneous matters, are slightly crushed between two rollers, freed by hand from husks and coloured grains, and enclosed in clean gunny. They then receive a slight pressure in an oblong mould, which gives a uniform shape and density to the packets of seeds. The 'bricks,' as they are technically called, are then placed alternately with plates of sheet-iron in the ordinary screw or hydraulic press. The oil thus procured is received in clean tin pans, and water in the proportion of a pint to a gallon of oil being added the whole is boiled until the water has evaporated. The mucilage will be found to have subsided and encrusted at the bottom of the pan, whilst the albumen, solidified by the heat, forms a white layer between the oil and the water. Great care must be taken on removing the pan from the fire the instant the whole of the water has evaporated, which may be known by the bubbles having ceased; for if allowed to remain longer the oil, which has hitherto been of the temperature of boiling water, or 212 deg., suddenly rises to that of oil, or nearly 600 deg., thereby heightening the colour and communicating an empyreumatic taste and odour. The oil is then filtered through blanket, flannel, or American drill, and put into cans for exportation. It is usually of a light straw colour sometimes approaching to a greenish tinge. The charred seeds yield from 47 to 50 per cent. of oil, worth in England from 4d. to 6d. per lb."

Castor oil, which has been well expressed, should be

insipid and nearly inodorous. It is viscid, transparent, and colourless, or of a pale straw colour, heavier than the fat oils; the smell depends much on the age of the oil as does also the taste; for when rancid—and it soon becomes so—both taste and smell are excessively nauseous. Various methods have been suggested for disguising the taste of castor oil when given as a medicine, but very few of them, if any, have the desired effect. Formerly there was a duty on castor oil of 1s. 3d. per cwt.; but in 1845 this was repealed. In pure sulphuric ether, and in alcohol, castor oil is soluble, and sometimes the bruised seeds are merely macerated in alcohol, which extracts their oil, to the extent of six ozs. of oil to every pound of seed.

Castor oil is much used in medicine. The Hindoos not only use it internally, but apply it externally in cutaneous diseases.

In India the *Ricinus communis* is generally raised in free mixed soils, and both the *R. viridis* and *R. communis* do well. Both plants have strong woody stems, often growing to 12 feet in height, though only annuals. They live about eight months, the seed being sown in November, and again in May; the leaves are procurable all the year round, so that when these plants are raised not for oil, but for feeding silkworms, the supply of food can be easily kept up.

The exports of this year in castor oil are considerably in advance of last, for some 1,411,216 gallons were exported in 1877-8 as against 1,398,536 gallons in 1876-77. The oil, however, is exported almost exclusively from Calcutta, as it is there that it is chiefly manufactured, while the seed crushed in the mills is brought up from Madras. Mr. O'Connor says that there is no valid reason why the seed should not be crushed in Madras, instead of being sent all the way to Calcutta for the purpose.

This oil is sent to the United Kingdom, Mauritius, the Straits, Ceylon, and Australia. It appears to be chiefly used for purposes of lubrication, for machinery, &c., a great deal of the exports consisting of the coarser oil obtained from the *fructibus majoribus*, the seeds of which are usually toasted before they are boiled, this giving the oil a more disagreeable smell than the medicinal oil, it being also of a coarser nature. It is this kind which is generally burnt in lamps; it is also in request with veterinary surgeons.

CALLOPHYLLUM INOPHYLLUM.

This species of *Callophyllum*, indigenous in India, was brought as early as 1793 before the notice of the botanical world, as a very valuable oil yielder; in India, however, its uses had long been known.

Recently the cultivation of this tree has been strongly advised. The *Indian Agriculturist* gives an interesting account of this oil-yielding plant, from which I extract the following particulars. In Southern India the oil obtained from it is known as *poonay* or *pooṅ*; in Orissa, as *poonug*; and in Hindostan as *sur-pun-ka-tel*. Apart from its value as an oil-yielder, the tree gives a timber which is said to be superior for the knees of ships, and crooks in general, to any other kind of wood; the grain of the wood is coarse, but it is strong, durable, ornamental, and in great request for shipbuilding both in India and Ceylon. The tree is also valued for its appearance, its leaves being beautiful, and flowers fragrant. The former are "opposite, simple, coriaceous, shining, close-veined, entire; the latter are axillary, drooping in racemes, fragrant, white, polygamous." This technical description will convey a very slight idea of its beauty to the non-botanical reader; but the leaves are of a rich dark green,

beautifully veined, leathery to the touch and oval in form. In Java it is grown almost entirely as a foliage plant or rather tree.

A nursery of young plants has lately been started in British Burmah, with a view of introducing the *Callophyllum inophyllum* into that country; and so far the attempt promises to be a success. The more general cultivation of this valuable tree from an economical point of view, is much to be desired, and it is to be hoped that attention will be decidedly drawn ere long to its very valuable properties; for its cultivation might with considerable faith be counted on as a new Indian industry. The special recommendations it appears to have are, first of all, its easy rapid culture, seedlings, as a rule not being transplanted, but put down where their sites have been chosen, and allowed to remain there for the rest of their existence. They thrive better if within the radius of sea-breezes, and delight in a sandy soil, which has pointed to Rangoon as a favourable spot for their culture.

The seeds are said to yield 60 per cent. of their weight in oil, which is a larger percentage than that yielded by most oil-containing seeds.

The natives use it chiefly as a medicine, but not for culinary purposes. They also use it for lighting, but not for lubricating, *khoberajes* (native doctors) prescribe it as a remedy in rheumatic affections, and *dâk-wallahs* employ it for torches, to scare away animals while running at night. As it is now sold in the bazaars in India and Burmah, it is in a very crude unrefined state; the price it fetches in the Hill States and in Calcutta being about 10 rupees per maund. It is certain that if care was used in expressing, the oil would improve in colour and in quality; and instead of being, as it generally is now, of a dirty greenish colour, full of impurities and opaque in consequence, it would be as limpid as "cold-

drawn" castor oil. At Travancore this oil is that most commonly used for lamp burning. It is manufactured in that province, so Col. Dury says, in large quantities, especially in the southern district, and is there known as "Pinnay oil." It is not exported, except in very small quantities, to Ceylon. There is no reason, however, why in future years it should not figure in India's list of exports; for its valuable qualities only require to be improved by cultivation of the tree itself, and more care used in expressing the oil, to attract the attention of the commercial world to its utility as a fixed oil.

CHAULMUGRA OIL.

This is a comparatively new oil in Europe; but has long been known both in China and India. In this country Mr. Christy has been the means of making its usefulness more appreciated. In his account of the *Gynocardia odorata*—the seeds of which tree yield this oil, he draws particular attention to its great therapeutic value, in cases of consumption, leprosy, and other diseases of the same nature; it has long, in India at least, been highly valued, also in the Mauritius, where "it is considered to be the only reliable remedy for leprosy; and so high a value is put on its purity, that the seeds are imported from India for the purpose of obtaining the oil free from adulteration." Trial has been made of the oil for St. Peter's Hospital, Berners-street; in the Margate Infirmary; Royal Hospital for Diseases of the Chest, City-road; in St. John's Hospital, Leicester-square, and in other Hospitals. The *Gyno cardia odorata*, also called *Hydnocarpus odorata* (Linn.) belongs to the natural order Bixaceæ, is indigenous in Peru, various parts of the Malayan peninsula, in Assam, Khasia, and also in Sikkim. It has a roundish fruit

not unlike an orange, which contains numerous seeds, which yield oil by expression; its taste is rather unpleasant, also its smell; and the oil purchased in the Indian bazaars is usually rendered so impure by adulteration that its efficacy is very much impaired. Mr. Christy draws attention to this, and says that the natives carry on this adulteration of chaulmugra oil to such an extent, and it is so hard to detect the impurities, that the value of the oil medicinally has thus been brought into disrepute. In England and Paris it is slowly coming into use, and a new and possibly important industry may be here opened up; for it is certain that when perfectly pure, this oil is a most valuable one.

COCOA-NUT OIL.

This oil is contained in the kernels of the nuts of the cocoa palm, or *Cocus nucifera*. This tree—the use of which it is difficult to over-rate to the inhabitants of those countries in which it is found—is distributed within the intertropical regions of both the old and new worlds. It was first introduced into this country from Ceylon, where it is found in great abundance; it also abounds on the Malabar and Coromandel coasts, on the great Coco Island in the Bay of Bengal, and on the shores of equinoctial Asia and its many islands.

The uses to which the cocoa-nut palm can be put are innumerable. The roots are chewed by the natives in many places as a substitute for the areca-nut; the young buds form a species of vegetable, and are said to be excellent eating; the juice of the stems furnish a sort of palm wine, and toddy from which arrack is distilled. The vinous sap is procured by cutting off a young flowering branch or spadix close to the top, a chatty or red earthenware pot is fastened on to the stump, which

catches the juice as it flows; this is emptied in the morning, and the stump is cut again and again, until all the juice has been extracted. A coarse sugar, called jaggery, is made from this liquid, as well as a fiery spirit distilled from it. One hundred gallons of toddy are reckoned to yield about twenty-five gallons of arrack. The large leaves furnish shade when growing, are used as thatching for the native mud huts, and they are also made into baskets, buckets, hats, lanterns, &c., and are even used for writing purposes; when burnt their ashes yield potash in abundance, brushes are made also from them by bruising the end of a leaf with a portion of the mid-rib adhering to it.

The fruit when ripe is excellent for food, the milk it contains being refreshing and cooling. The bark forms a valuable fibre, and is described under the head of Fibrous Substances ("COIR"). The shell of the nut is made into drinking cups, and the white solid kernel yields by expression the cocoa-nut oil of commerce, which is made as follows:—The kernel is extracted from the shell, and boiled, subjected to pounding, and afterwards very heavy pressure; the substance is then reboiled, and the oil skimmed off as it rises to the surface, and boiled again by itself. By this process fifteen or sixteen nuts will yield two quarts of oil. The fluid and concrete parts of the oil are separated by pressure. "The congealed cocoa-nut oil of commerce is put into strong linen bags, these are covered with thick sackcloth, and laid flat upon the horizontal bed of an hydrostatic press, leaving a small vacant space between the bags. Pressure is then applied and continued until the oil ceases to flow through into a cistern fixed beneath. After the oil has remained a sufficient time at rest for the subsidence of its impurities it is drawn off quite clear." The residue in the bags is found to contain many impurities, such as fibre, mucilage and

other extraneous matter. It is purified by being put into a tinned copper boiler, sulphuric acid is then added two per cent. in weight of the acid, 1·8 spec. grav., diluted with six parts of water. The action of the acid, assisted by heat, coagulates and precipitates the impurities, which are during the straining process removed, and from the substance remaining very good candles are manufactured, which are in considerable demand.

In India the oil is used for culinary purposes, but chiefly to burn in lamps; the light it gives being pure and steady. In the United Kingdom it is employed by soap and candle manufacturers, and lately great improvements have been effected in the preparation of the oil; its value from a commercial point of view is considerably enhanced, and it is now applicable for various purposes for which it could not before be used. Cocoa-nut oil must not be confounded, as it too often is, with *palm oil*, because that is obtained from a different species of palm—the *Elais Guineesis*, found in Africa on the western coasts, and also in Brazil.

The common cocoa-nut palm grows from 50 to 90 feet. It has no branches; but the immense length of the leaves, from 12 to 15 feet, compensate it for the want. They have large strong middle ribs. The fruit is nearly as large as a man's head. The external rind is tough, not very thick, and of a brownish red colour; beneath it there is a quantity of the fibrous matter before mentioned; then comes the shell of the nut, within which lies the milk-white kernel, which is hollow in the middle and filled with milky fluid. When the nut is young and green the whole of the shell is filled with fluid; as it ripens, however, it solidifies, only the very centre remaining in its fluid state.

Each tree bears from 80 to 100 nuts, and the trees vary in price, according to age, from 8 annas to 5

rupees. Each tree is also in some parts of India taxed, a yearly tax of a few annas being paid to the Sircar. Plantations of cocoa-nut palms are therefore of decided value. In Ceylon the greatest care is bestowed on the trees, the Cingalese setting a very great value on them. They are said to grow best near the sea, in low sandy places, not considered difficult to rear with due attention, anywhere in a mean temperature of 72 deg.; but not growing with such vigour when planted far inland, as when under the influence of a sea breeze.

In planting the nuts, attention has to be paid to the method of setting them in the earth. Everyone will readily notice the three scars to be seen on each nut; in fact, many say the name is derived from the Portuguese name for monkey, *macoco*, because these three black scars are supposed to bear a resemblance to a monkey's face. These marks indicate the places where the embryos of the fruit would protrude; these spots should be all soft, only one is, however, usually in this state, which one this is can be easily discovered, and it is here that the germinating embryo finds its way out. Before the nuts are sown they ought to be perfectly ripe, and the whole nut is not buried in the earth, being about two-thirds covered. They are usually planted in Ceylon before the rains, and in four months the germination has fairly commenced. They do not bear fruit until the fifth year, sometimes not till the eighth; but they continue bearing for over seventy years, being at their best and fullest growth from twenty-five to thirty or thirty-five years. The stems are marked on the outside with rings, which the fall of the leaves produces; two leaves are said to fall each year, the age of the tree being estimated by its number of rings.

Ceylon ships a great quantity of nuts, fibrous mat-

ter, and oil yearly, and considerable quantities are also exported from the Malabar Coast. In ordinary seasons the oil fetches in England from £40 to £50 per ton, as much as £70 per ton being realized on some occasions. The freight of the cocoa-nuts themselves when exported costs very little, as many captains use them as wedges to set round casks, and to fill up vacuities caused in packing their cargoes.

The home consumption of the cocoa-nut oil in India is large, and great quantities of it are manufactured in Bengal. From 1870-71, 7,818 gallons were exported from thence, valued at 11,772 rupees. From Bombay during the same period 61,735 gallons were exported, valued at 96,561 rupees; while Madras, during 1869-70, exported 1,088,887 gallons, valued at 15,19,125 rupees.

LINSEED OIL.

The *Linum usitatissimum*, or common flax, is largely cultivated in India, chiefly, however, for its seeds: and not, as in Europe, for its fibres. Recently more attention has been paid to its uses as a fibrous plant in India. (See "FIBROUS SUBSTANCES—FLAX.")

Linseed oil is procured by cold expression of the seeds, also by roasting the bruised seeds in oil-mills; but the oil obtained without heat is the more pure and the clearest in colour, neither does it turn rancid so quickly as when the roasting method has been followed. The oil is pellucid, its specific gravity 0·93, it dries readily, only becomes cloudy when subjected to great reduction of temperature, and can easily be purified by filtering through charcoal, or bleaching in the sun, or by agitating it with water. The oil prepared in India is very much deteriorated by flax seed and mustard seeds being mixed together. The crops being often

sown together, this lessens the drying properties of the oil, and detracts from its quality. The seeds are therefore imported in their natural state, and expressed in the United Kingdom. A bushel of East Indian seeds will yield, it is calculated, from 14 to 15 lbs. of oil. Dr. Royle states that the export of linseed from Bombay alone is estimated at four lakhs of rupees annually. The plant is largely cultivated for its seed alone in the Bombay Presidency. It is difficult, however, to arrive at the real amount exported, as linseed comes under the head of "SEEDS," linseed represents, out of the total of seed exports from India for 1877-78, which is stated by Mr. O'Connor at 12,187,020 cwts., some 7,198,918 cwts. The trade of last year was one of increased activity, which is accounted for by the marked decline in the Russian exports, and also the rate of exchange. The exports to the United States, however, decreased, which the collector of customs at Calcutta attributes to the protective duty on linseed imposed by the United States tariff; but it is more probably owing to the demand for Indian linseed having so very much increased in the United Kingdom within the last two years, the period during which the decline of the trade with the United States is so strongly marked.

This oil is one of the chief ingredients in oil varnishes and in printer's ink. The varnish maker is most particular in his choice of the oil, for the beauty and also the durability of the varnish depend so much on its purity. Oil from unripe seed is always watery; from fine full-grown seed it is pale, brilliant, and pellucid, sweet to the taste, with little or no smell, and has the quality of drying quickly and thoroughly. The linseed oil varnish is made as follows:—"Boil linseed oil, 60 parts, with litharge 2 parts, and white vitriol 1 part, each finely powdered; boil until all water is evaporated, then set by."

This varnish is in constant use for various sorts of work.

Artists also use linseed-oil, but for their use it has to be purified until it is quite colourless, which is done either by exposing the oil in a bottle in the sun for some days, or else putting powdered whiting into the bottle of oil, shaking it well and then putting it into a not too hot oven until the whiting is found to have settled at the bottom of the bottle; having carried down all the impurities of the oil with it, the pure oil floating on the top should be poured off and kept for use.

In preparing printer's ink the oil is boiled for a long while, until it is thick, dark-brown, and tenacious.

It is also used in medicine to form liniments, and as an application mixed with lime-water for burns, also in various internal disorders. And besides all these different uses, the seeds, after having had all the oil expressed from them, are made into oil-cake, which is a very fattening food for cattle. The seeds are also given to cage birds. In appearance they are oblongo-ovate, acute compressed, of a brown colour, smooth and shining with a thin skin, and a white oily kernel; the oily matter is contained only in the kernel, the skin containing the mucilaginous part of which linseed is also composed, the proportion being 1-5th of mucilage to 1-6th of fixed oil. Linseed is grown in Russia, Italy, and Egypt, Holland, and America; and from the three first named large quantities are exported yearly.

MALWAH OIL.

The Mowah, Mhowa or Malwah tree—the *Bassia latifolia* of Roxburgh, is one highly valued by the Hindoos; but more on account of the coarse fiery spirit distilled from its flowers, than from its oil-producing properties.

The tree itself bears a decided resemblance to our oak, in size, form, and colouring of foliage. It grows to about 40 feet in height, flowers in March and April, and is found chiefly in the Concans, the Circar mountains, and Bengal, Guzerat, and Rajputana. The flowers are produced in great profusion; they grow in large full bunches, have a sickly sweet taste, and are usually eaten raw, though they are also dressed in various ways, sometimes as a preserved fruit, or used to flavour curries, and other savoury dishes; but they are chiefly used in distilling the strong and intoxicating spirit before mentioned. The oil is expressed from the seeds.

The trees, which in good seasons produce from 200 to 300 lbs. of flowers each, are never entirely stripped of their blossoms, some being always allowed to remain. They are succeeded by a fruit about the size of a small apple, and in the kernels or seeds contained in the fruit is found the oil: it is of an inferior quality and somewhat rancid taste; but is largely used by the poor of India, in their lamps, in ghee, for cooking purposes, and also externally as a remedy for cutaneous diseases, and wounds.

To manufacture the oil the seeds are extracted, bruised, rubbed, and subjected to pressure. Directly the oil is expressed it concretes. It is coarse rather thick, and mostly used by those who cannot afford to buy the more superior oils. In the manufacture of soap it is largely used; and was recommended in 1848 by the managing director of Price's Patent Candle Company, to whom some Malwah oil was forwarded to be experimentalized with. He stated that in England it was worth for the manufacture of candles about £8 per ton less than Petersburg tallow, and was in value equal for the purpose to cocoanut oil, only the colour was inferior, which, however, was made up for by its

being harder. The probable value of it in the United Kingdom would be about £35 per ton.

Most Indian villages, in places where the malwah tree is found, have their spirit-shops, where the spirit distilled from the flowers is sold. Hooker stated that the Government duty on the spirit distilled chiefly from the flowers in the island of Caranja amounted to at least £60,000 per annum. The spirit is rather like Irish whisky, having a smoky flavour. When new it is highly injurious, but age improves it considerably, especially if it has been carefully distilled.

The tree is a hardy one, thriving well even on poor stony ground, and therefore can be grown on land which is unsuitable for ordinary crops. It yields its flowers with the greatest regularity, and a bad malwah season is hardly ever known. The flowers are useful fresh or dried; and the seeds are, as I have shown, most valuable for the oil contained in them. The culture of malwah trees might with advantage be fostered by Government, because they yield a considerable supply of food to the natives, produce a revenue by the duty on the spirit distilled from their flowers, and are grown without any outlay, being very easily propagated by seed, the trees indeed propagating themselves in India, the seed being generally self-sown.

PETROLEUM.

Attention has of late been attracted to the mineral oils of Burmah and Assam; and it is thought that what is spoken of as the "Petroleum enterprise" will prove a source of considerable wealth to these countries.

Petroleum, or rock oil, "a viscid variety of bitumen," has been known for many centuries, being found in many different parts of the world: in Italy, on the

borders of the Caspian Sea, in the West Indies, Burmah, Rangoon, East Indies, Persia, and in immense quantities in the United States; also in California, and other places. Our chief supplies have hitherto been imported from Pennsylvania, Canada, and the United States. Now, however, America does not yield the amount of oil it once did; and if the new mineral industry is thoroughly worked in Assam and British Burmah, that is, if capital be forthcoming to fairly start the enterprise, there is every prospect of the rock oil of Arakan being a commercial success. Mr. Willoughby Savage, to whose energy the projected "Arakan Petroleum Company" is due, has prospected the country in which these rock oils abound; and in the pamphlet containing the reports of Mr. F. R. Mallet's geological survey, full information will be found on this subject. In Mr. Savage's property at Minbain, in the island of Ramri, there are some 70 oil wells; and the country is said to resemble very closely, both in geographical features and position, the best oil-producing localities of America. In British Burmah the oil was observed in many places to be oozing from the ground, and the careful inspection of the gentleman before named leaves it certain that at stated depths oil would be found. Colonel Pollok, in his recent book "Sport in British Burmah," mentions the oil wells which exist both in Assam and Burmah. The old oil wells of Burmah, which have been famous for hundreds of years, and are said to produce from 400,000 to 600,000 hogsheads yearly, are situated about forty miles beyond our frontier, but there are some existing also in our provinces. Colonel Pollok thus describes his visit to Yan-nan-Choung, where the petroleum wells are. He writes:—"We halted for a day, and visited them; they are about three miles inland; so starting early,

we got there about seven, and spent an hour examining them and watching the extraction of the oil. Generally these wells are very deep, a few as much as 300 feet. The effluvium is most sickening, and when a well requires excavating there are but two or three men capable of undertaking it; and they cannot remain down for more than a minute or two, occasionally men lose their lives in going down. In the neighbourhood of the wells there is not a blade of grass—nothing grows within several hundred feet of the vicinity where this oil is found. This property in former years belonged to some dozen families; and they agreed to intermarry, so as to keep their interests intact; and this was acted up to for several generations, but the elders now complain that the young men and women are getting independent, and that the girls either marry outsiders or that the young men bring strangers home as wives, and that the property is rapidly decreasing in value. It is a monopoly of the King's, and pays well. Why the wells in Assam, which are far finer, do not do so, I can't conceive, unless bad management is at the bottom of it. When the wells in Assam were first tapped, the petroleum jetted out several feet into the air, and was purer than that found in Burmah. In Burmah they have now obtained machinery, and are manufacturing candles, soap and kerosine oil, from this petroleum, and it can be sold at a rate much below that imported from America. This oil floats all over the water round [illegible], or 'stinking-water-stream,' and emits a fetid smell, from which we were glad to escape."

Why the oil found in British Burmah and Assam, should not become as valuable as that found in the King of Burmah's own dominions it is impossible to say. And just at this time, when the American oil wells are not in such a flourishing condition, it is of

course the very time to push forward Arakan oil into the market. Those learned in the subject say the area to work over is a large one; and oil may be found in it of good quality and in unlimited quantities. Mr. Mallet is of opinion that "Arakan is an oil territory by itself, entirely separate from Assam or the wells of the King of Burmah." Mud volcanoes have always been thought to be connected with mineral oil, and mineral oil and salt are frequently associated, being found together in the Punjâb, in Assam, and also in Burmah. In the Ramri rocks Mr. Mallet found saline matter, also in Java; and at Baku, on the shores of the Caspian, mud volcanoes and petroleum are found in close proximity; but in Arakan this is not the case, and, as before mentioned, Arakan is an oil territory to itself. "The Ramri or the Arakan oils are associated with much gas, and are themselves sometimes as transparent and light coloured as brandy, and at 60 degrees they are perfectly mobile."

"Petroleum is supposed to be supplied from the natural distillation of carbonaceous matter, the agent being subterranean heat." This would account for the amount of coal-gas generated with it. Sometimes this gas issues with such immense force that the sound even at a great depth can be heard from the surface. This is the case in America, India, and other earth-oil regions. The amount of petroleum imported by the United Kingdom has largely increased of late years. In 1868 the importations were not much over 4,300 gallons, while in 1874 they exceeded 21,400,000 gallons.

POPPY OIL.

A bland oil is extracted from the seeds of the white poppy, which is extensively cultivated for this purpose, as well as for making opium, not in India

only, but also in France, Germany and the Netherlands.

Under the head of "Opium" I have fully described the growth and cultivation of the *Papaver somniferum*. The oil is obtained from the seeds alone. The sowing for seed cultivation, in distinction from that for opium, takes place in March and April. About two lbs. of seed are considered enough to sow one acre, and it is scattered broadcast over the land. In August the seed vessels are full and fit to be gathered. The poppy-heads are then cut off the plants as they stand in the field, the coolies collect them in baskets, and empty them out on a cloth spread out to receive them in the same field. The heads are afterwards sorted over and put into bags; while in these bags they are well trodden out either by coolies, or else bruised and beaten out by mallets and flails. By either method the seeds are extracted from the heads, and when this operation is complete they are taken off at once to the crushing mill to be expressed; [illegible] the seeds are, the more [illegible] four lbs. of fresh seed [illegible] has been obtained. Great care [illegible] the mill, the press, and the bags [illegible] of the oil are in a perfectly [illegible] the oil will be impaired.

Poppy oil is transparent [illegible] render it colourless [illegible] vessels to the action of [illegible] desired effect. It is [illegible] olive oil for cooking purposes, [illegible] natives in the preparation of [illegible] they sometimes [illegible] been expressed. It [illegible] to burn in lamps; [illegible] oil; in oil painting, [illegible]

strength and tenacity to linseed oil, it has the reputation of keeping its colour better, and is on this account much employed by artists in grinding white, and in most of the light pigments. It is used also in the manufacture of soft soaps by soap-boilers, and is made into oil cake for the use of cattle. The ordinary narcotic properties of the poppy are not transferred to the seeds, which it has been proved are quite devoid of any narcotic principle, the oil obtained from them being perfectly pure and wholesome. At one time, however, before this fact was clearly ascertained, the idea that they contained the same soporific properties as the poppy-heads was very generally entertained; and so largely did such opinions prevail, especially in France, that in that country a decree was passed in 1718 to prohibit entirely the sale of poppy oil, whether pure or mixed with other oils, the penalty being a fine of three thousand livres. But even this did not stop the trade in this oil, which rapidly increased. In 1783 an Agricultural Society was appointed to thoroughly examine and investigate by chemical analysis the properties of poppy oil. The investigation was exhaustive, and the tests severe; and it was satisfactorily proved that the seeds contained no deleterious properties. From that time the prejudice against the use of the oil gradually died away; and though of recent years the importations from India have not been so active as in 1866, when their value reached £115,786, they have been sufficient to prove the commercial value of poppy oil. In India the price of this oil is about 4-8 rupees per maund, a maund being capable of holding, on an average, 25lbs., or about £40 6s. per ton.

[illegible]

The *Sesamum Indicum* is [illegible] the Malabar coast, [illegible] India. It is an annual [illegible] meæ, frequently called [illegible] ous stalk, grows from [illegible] out only a few branches. [illegible] flowers axillary and [illegible] resembling in shape [illegible] seeds which produce the [illegible] ous. This plant must have been [illegible] times, because reference is made [illegible] It is very generally cultivated [illegible] Africa, Egypt, Syria, Russia, America, [illegible] Indies. It is an easy [illegible] is bland and of good quality, readily [illegible] seeds by expression.

Til, or *gingely-oil*, as the Hindoo [illegible] the most useful of all the [illegible] the country; it has the [illegible] years without turning rancid. [illegible] cured by giving the seeds [illegible] in cold water, until all the [illegible] removed, and they look quite white. [illegible] spread to dry in the sun, after which [illegible] extracted from them by pressure. [illegible] are said to yield two quarts of oil, [illegible] straw colour, sweet tasting, and [illegible] same purposes as olive oil.

There are two sorts of the seeds, [illegible] merce—the white and the black, the [illegible] most common. The sorts are also [illegible] being called the black—"first-sort gingely" [illegible]

white, "second-sort." The first, which is sown in March, yields the largest percentage of oil. It is ripe in May. The other is sown in June, and ripens in August. Both sorts of oil fetch the same price, *i.e.* from 2-14 rupees to 3 rupees per maund, or about 25lbs. It is a pity it is not more cultivated for exportation; for though a considerable quantity of sesamum oil is imported by England, it is brought chiefly from Egypt. The plants flourish well with ordinary care throughout India, and might form a source of revenue, if cultivated more largely, for exportation, as well as for home consumption.

The natives not only use the oil in preparing their food, but medicinally as well, having great faith in its healing properties, for dressing wounds, and in the treatment of ulcers, rheumatism, &c., and also for dyeing silks.

There are very many other oil and fat yielding plants and trees found in British India; and their produce in use amongst the natives besides those described; the following list, gathered from Col. Dury's "Useful Plants" and D. M. C. Cook's "Report on the Oil Seeds and Oils in the Indian Museum or produced in India," contains the names of those best known:—

Acorus calamus (Linn.).
Aleurites triboba.
Amoora Rohituka (W. and A.).
Anacardium occidentale (Linn.) cashew-nut.
Anamirta cocculus (W. and A.) "cocculus indicus."
Andromeda Leschenaulti.
Andropogon citratum.
Andropogon Martini (Roxb.).
Arachis hypogæa (Linn.).
Argemone Mexicana (Linn.).

Atalantia monophylla (Corr.).
Bassia butyracea (Roxb.).
Bassia lutifolia (Roxb.).
Bassia longifolia (Linn.).
Brassica campestris (Linn.).
Bryonia callosa (Rottler).
Buchanania latifolia (Roxb.).
Butea frondosa (Roxb.).
Carthamus tinctorius (Linn.).
Carapa Moluccensis (Roxb.).
Celastrus paniculatus (Willd.).
Citrullus colocynthis (Schrad.).
Croton tiglium (Linn.) see "DRUGS."
Dipterocarpus lævis (Hammond.)
Euphorbia dracunculoides (Lam.).
Excæcuria Sebifera (Muller).
Gossypium herbaceum (Linn.).
Garcinia pictoria (Roxb.)
Garcinia Indica (Chois).
Hibicas cannabinus (Linn.).
Jatropha curcas (Linn.).
Mimusops elengi (Linn.).
Moringa pterygosperma (Gærtn.).
Nicotiana tabacum (Linn.).
Pandamus odoratissimus (Linn.).
Pogostemon Patchouli (Pellet.).
Pongamia glabra (Ventenat).
Santalum album (Linn.).
Sinapis juncea (Linn.).
Semecarpus anacardium (Linn.).
Shorea robusta (Roxb.).
Tamarindus Indica (Linn.).
Tectoria grandis (Roxb.).
Terminalia catappa (Linn.).
Terminalia chebula (Retz.).

Numerous other oil-yielding shrubs and trees could be mentioned; but these will be sufficient to show how vast are the resources of India in oils alone. Many of those named are quite unknown in England, though the natives appreciate and use them.

CHAPTER XX.

OPIUM.

The Indian opium is produced in Bengal, chiefly in the Bahar and Benares provinces; in Bombay, and in Malwar in Central India. In Bengal it is a Government monopoly, the cultivator having to deliver the entire crops to the Government agents at the contract price, which is about 3s. 6d. per pound. Government sells again at about 11s. per lb., thus profiting at the rate of 7s. 6d. per lb. This monopoly is without doubt oppressive, and interferes with the industry of the cultivators, those who grow the poppy being obliged to sell their produce at an arbitrary price fixed by the Government agents. To allow all who wished to cultivate opium to do so on the taking out a licence, and then to lay an excise duty on the prepared article would obviate much of the oppressiveness of the monopoly; and while opening up a new source of wealthy cultivation would materially increase the revenue derived by Government. No persons, however, under the present system are allowed to grow the poppy except on account of Government, into whose hands the whole produce of land so cultivated is delivered at the contracting rates above alluded to.

The Behar opium, known in the trade as Patna opium, is a very important crop. It is prepared at the Government agencies of Patna, at Ghazipur,

and is sent to the *godown* in earthern jars, containing about a maund each. These are weighed in the presence of a European assistant, then separately examined by the agent's chief assistant, who acts as the examining officer, and who has, subject to his agent, the charge of the *godown*. When the opium has been passed, and its consistency thoroughly tested, a receipt is made and forwarded to the district officer, who pays the cultivator for it according to the contract rate. In the busy season 800 to 1,000 hands are employed in an opium *godown*.

The Bombay opium revenue is derived chiefly from that grown in Malwa, which pays a heavy duty on entering English territory. Opium may be grown in Bombay also, but is subject to a like duty as that imported from Malwa.

The opium poppy, *Papaver somniferum* (Linn.), is an annual herbaceous plant, from three to four feet in height, the stem smooth and glaucous; leaves incised and toothed, resembling in appearance those of our lettuce; flowers large and showy red, white or purple. The species are 25 in number. The *Papaver somniferum*, the dark, red-flowered and black-seeded kind, is chiefly found in the Himalayas; but it is not so generally grown in India as the white-flowered, and white-seeded sort, *P. officinale*.

In many parts of Europe poppies are cultivated on account of the oil contained in their seeds, which is very valuable; to which I shall have occasion to refer presently.

The cultivation of the poppy is simple enough, it requires a rich soil, frequent irrigation and weeding, space, and good manuring.

The capsules yield the milk-white juice which concretes into opium. The process by which this juice is obtained is called bleeding, and usually commences

early in February and March; directly the flowers fall the capsules begin to enlarge, and then the first bleeding process takes place The collectors are furnished with three lance-shaped bits of iron, small and very sharp. These are bound together with cotton, only a bit of blade about one twelfth of an inch being visible. An incision is made with this instrument, cuts being made straight up the stem of the cane to the head of the capsule. Each plant is bled four times, allowing from three to four days to elapse between the bleedings. The milky gummy juice which has exuded during the night is scraped off in the morning and collected. In scraping off, the operator leans rather heavily on the blunt scraper as he passes over the capsule: this causes a considerable portion of the pubescent outside coating of the poppyhead to be mixed with the hardened juice. This is one of the first adulterations to which opium is subject, the purity of the drug is contaminated by the downy matter mixed with it, but the quantity obtained is thereby increased; it is next adulterated with linseed oil, in which it is soaked. The difficulty of procuring thoroughly good opium can therefore be easily imagined. After the drug has been soaked in oil it is tied up in bags, which are hung up to rafters in rooms nearly dark; here they remain about ten days or a fortnight, the spare linseed-oil having by that time dropped through the bags; often they remain a longer period, but at the end of the fortnight the oil has generally escaped. The opium on being taken out of the bags is made up into balls, or cakes. These are dried in cases, or drawers in the *godowns*, exposed to a current of air. They are then covered with leaves, prepared chiefly by women, of the petals of the poppy flowers, which have been baked. These leaves are paid for at the rate of 4·8 to 5 rupees the maund

The pods of the plant are, after the seed has been extracted, prepared for the dunnage boxes in which the balls are packed. Each box or chest holds about 40 balls, each ball containing 1 seer 10 chittaks, factory weight, of opium, at the value of 70 degs. consistence.

The cultivation and raising of the poppy are tolerably easy: but as the plant is a delicate one, and liable to many injuries from wind, hail, and rains at unseasonable periods, considerable care has to be exercised during the entire period of growth.

Some experiments were made last year, under the auspices of the Board of Revenue for the Lower Provinces, for the improvement both of poppy cultivation and of the plant itself as a drug producer. At Dugah, in Bengal, ridge cultivation and foreign selected seed have been experimentalized with, and with good results. The superiority of ridge cultivation was proved beyond dispute. The surface of the ground, instead of being caked by the application of water, was gently watered by its admission along the furrows, which allowed the growing plants to absorb gradually the necessary moisture, and the selected seed gave a larger out-turn of a superior quality of drug. Mr. Scott was also enabled to prove and establish the important scientific fact "that the function of the milk juice of the poppy is of a *protective nature* in the poppy, and probably in other milk-juiced plants. Caterpillars will not touch the plant when once the milk has begun to develope its special characteristic."

The produce of poppy cultivation runs in extremes, which makes it rather a precarious species of farming. For example, one year cultivators may be in a state bordering on despair, the out-turn of the season actually not repaying the labour put forth; and another year the increase may be great and the profits proportionate.

The monopoly of opium in Behar was first assumed by Government in 1778; the exclusive provision of opium, on account of the company, was let in farm, first of all annually, but subsequently from the year 1781, in successive contracts for four years, the contractor engaging to deliver a certain quantity of opium at a fixed rate to be paid by the Government. Under this arrangement, however, it was found that the opium deteriorated in quality, and the Government profits in consequence materially decreased. So the agency system was resorted to, and from the time the first agent was appointed there was a marked improvement in the trade, which continued steadily to increase. The numbers of chests of opium in the first year of the agency were 3,733, while in 1838-9 there were 11,629 chests. At this period a great change took place in the China trade, owing to the summary proceedings of the Chinese at Pekin, who had confiscated and entirely destroyed some 20,000 chests of opium belonging to British traders. Up to that time, though a prohibition on opium existed in China, the sale of the drug had been, as it were, winked at by those in authority, and the trade had gradually grown from a very small beginning into an important branch of industry, and traders began to act as though no prohibition on the article existed. This rapid increase of the opium trade caused, however, anxiety and uneasiness on the part of the Chinese Government, and the desire to put it down at once and effectually led to the outrage before mentioned. It was this act of violence that caused the Chinese war, which war did not terminate until 1842, when the Chinese not only paid 21,000,000 dollars towards the expenses of it, but a further sum of £1,250,000 to the owners of the confiscated and destroyed chests.

The prohibition on opium was not suppressed by

the treaty of 1842, it not being finally repealed till the year 1858, though the Act must virtually have been a dead letter, for the increase in the trade nearly doubled between the years named; and now that the embargo is taken off, and the importation into China legalized at a duty of 30 taels the picul, the trade yearly increases in value. It is a mistake to suppose that England first introduced opium into China, as it is certain that early in the sixteenth century the uses and abuses of the poppy were thoroughly well known to the Chinese, that is, fully a century and a half before the English had anything to do with its cultivation. It is supposed to have been introduced in China and India by Mohammedan traders. By far the greater portion of the opium used in China is obtained from India, a small quantity only coming from Turkey.

In a report recently compiled by Mr. W. M. Cooper, the British Consul at Ning-po, he says that it is extremely difficult to obtain any reliable statistics of the home-trade; that each year the acreage under poppy cultivation in China increases is a certain fact; also that the crops at Tai-Chow and Seang-San have this year done well; and that such an increase in the home cultivation of the drug could hardly be possible in the face of the Government edicts, were it not that some tacit understanding had been arrived at with the authorities. Patna and Malwa opium are, however, much more generally smoked in China than that grown in the country. The Malwa is the cheapest, and the most easily prepared for smoking. From 65 to 75 cash would be charged for it, while for Patna 110 cash would be demanded. "From a chest of Patna of 100 catties only 50 to 60 of the prepared opium is obtained, while from Malwa 70 to 76 catties is the product." Malwa is prepared for the pipe in a few hours, Patna

requiring at least 36 hours' constant attention before it is fit for use. Most imported opium finds its way into China *viâ* Hong Kong, the greater portion of the imports being from Malwa, Patna, Benares and other Indian opium districts. The trade is not, however, in the hands of very many merchants, the Indian importations coming chiefly from a few large Bombay houses. British merchants, though indirectly affected by the trade in general, know little, and care less about it; but it has been stated "that the remittances from China for opium by two of these houses alone are over £500,000 a month."

The opium returns form no inconsiderable item in our Indian revenue, as will be seen from the following figures:—

Year.	Indian Revenue.	Opium.
1873–4	£50,219,489	£10,274,422
1874–5	50,570,171	11,956,972
1875–6	51,310,063	11,148,426
1876–7	55,995,785	12,404,748

The importance of the trade is such that opium now ranks next to cotton in value as an export, being worth over ten millions sterling at the lowest computation, from 2½ to 3½ millions of that being clear revenue to Government from the duty on the drug, which amounts to something like 600 rupees, or £60 per chest. The revenue for last year was less by £347,000 than in the previous year; but though the number of chests exported was less by £4,050, the value was maintained at a high rate, only falling short by three lakhs of the preceding year.

The value of each chest in 1874–5 was estimated, so Mr. O'Connor tells us, at 1,262 rupees; in 1875–6, at

1,261 rupees; in 1876-7, at 1,281 rupees; and in 1877-8, at 1,333 rupees.

The amount of Bengal provision opium advertised for sale in the calendar year 1879 is 5,000 chests per month, half Behar and half Benares. That so much of our Indian revenue should be derived by the sale and duty on this drug is by strict moralists much commented upon; but there is reason to doubt, if they even had their demands for the entire prohibition of the opium traffic gratified, whether anyone would be very much benefited. Assuredly our Indian revenue would materially decrease, and the present is scarcely the time to try experiments, financial experiments, in India; numbers of natives would be thrown out of honest employ; and one of the great Indian cries is employment for natives. Besides, the first effects of such a course would be to make opium cheaper, and thus extend instead of lessening the consumption; for it would be next to impossible to prevent the growth of the plant in the country or illicit manufacture of the drug. Supposing that the cultivation of opium in India was entirely put a stop to, were such a thing possible, the Chinese would then cultivate more; for it is highly improbable that they would voluntarily suppress its growth, when we see that each year the home trade is increasing in the face of Government disapprobation. Neither would it be possible for us to interfere with them on this head; for the effect of a stoppage of the Indian imported opium would only render the cultivation of the poppy so much the more profitable to China.

Medical men, among others Sir Benjamin Brodie, contend that opium is not so injurious as spirits even when taken to excess. It is the *abuse* not the use of all stimulants which opens up the moral side of the question. Spirit drinking renders a man mischievously

mad. Opium [illegible]
useless [illegible]
ness; [illegible]
does opium [illegible]
a manner [illegible]
not arguing [illegible]
merely [illegible]
and [illegible]
on the [illegible]
we [illegible]
the [illegible]
own [illegible]

We are [illegible]
though [illegible]
if we [illegible]
ning up the [illegible]
too persistently [illegible]
possibly America [illegible]
with us [illegible]
ing as [illegible]
India [illegible]

As to the [illegible]
to its [illegible]
raising the [illegible]
best [illegible]
It has been [illegible]
very [illegible]
productive [illegible]
qualities. [illegible]
of spirits [illegible]
the duty [illegible]
sellers is [illegible]

CHAPTER XXI.

PAPER.

THERE are various grasses and fibres found in India from which paper can be manufactured; and at different times experiments have been tried with Roussa-grass (*Andropogon Martini*), which is common in many parts of India, and may be had almost for the cutting throughout the Deccan: this grass is a native of the highlands of Balaghaut, and plants have been reared in Calcutta and Lucknow from seeds brought from thence; its cost is very trifling—about one anna per cwt., and twelve seers (equal to 24 lbs.) have been found enough to make sixty quires of paper. The oil is extracted from the fibres before they are converted into paper. The quality of the paper is said to be good enough for newspapers, books, and so on.

The *Antiaris saccidora*, a large tree, furnishes a rough sort of paper made from its bark. *Zea mays* is also a paper-yielding plant; and in Austria at the Imperial Paper Manufactory at Schoegelmuchle the process of converting the dead leaves of maize into paper is largely carried on.

From the leaves of the fan palm of Ceylon (*Corypha umbraculifera*) paper is made; also from the inner bark of the *Daphne papyracea*—Nepaul Paper Shrub, which grows in Nepaul, Khasia, and Silhet. It is prepared in the same way as hemp. Dr. Royle tells us

that the paper made from it is very strong and durable, not subject to change from weather, and moth-proof. It is used all over Kumaon, and it is generally made in three qualities, in size about one yard square, the best quality fetches a rupee for forty sheets, and at wholesale eighty sheets, the second quality is sold at fifty sheets for a rupee and a hundred wholesale, and the third and smallest size runs a hundred and forty sheets to the rupee, and from a hundred and sixty to a hundred and seventy wholesale. Dr. Royle and Dr. Campbell both speak well of this paper. The art of making it is said to have been introduced into Nepaul from China about five hundred years ago

A coarse kind of paper is made from the inner bark of the *Grewia oppositifolia*, which grows in the Dehra Doon. And the common plantain *Musa paradisiaca* (Linn.) furnishes paper of good quality, Dr. Royle in particular speaking very highly of it, and considering the plant capable of supplying a large amount of material, suitable for manufacturing into paper of various qualities. But the plant now thought the most of in India as a paper-producer is the bamboo, which has recently had its properties severely tested.

The *Bambusa arundinacea* is one of the most useful of vegetable productions. It grows everywhere in the tropics, and is used for a variety of purposes. Really speaking it is a gigantic arborescent grass, with a ligneous stem. It grows usually from 40 to 50 feet in height; but is found sometimes from 70 to 90 feet. When it is fifteen years old, it is said to bear a seed very like rice—which is used by the natives for food — and after its seed-bearing to die. But many instances could be cited of its attaining nearly double that age. Bread is made from the seed. The young shoots form an agreeable vegetable, and when the bamboo has come to maturity it is used for

building purposes, houses, bridges, boats, masts of vessels, poles of palanquins, agricultural instruments, carts, hackeries, doolies, fishing-rods, oars, spars, are all made from bamboos, and, last but by no means least, *paper*. The bamboos are floated down the rivers, and from their buoyancy are used frequently in floating other heavier woods. The larger ones, from 60 to 70 feet long and 5 to 6 inches in diameter, fetch from 5 to 6 rupees standing; and the small ones 3½ rupees per 1,000. Millions are annually cut in the forests, and either taken away by land in hackeries or by water in rafts. In Cleghorn's "Forests of South India" a considerable amount of information will be found respecting this useful article. In the Central Provinces a bamboo, called by the natives "kuttung," is found, which grows to great size, and is of more value than the ordinary bamboo, but only met with in a few places, near Sironcha at Khampare, and around Bejaghur. In 1869-70 Colonel Beddome, in his report to Government, states that in the Wynaad, Coorg, S. Canara, and portions of the Anamallays, the bamboo (*Bambusa arundinacea*) was gradually dying out. It is, however, a rapidly growing plant, and after the flowering, seeding and dying off of the old plants, young ones spring up on all sides, the seeds quickly germinating.

Mr. Thomas Routledge has written in the *Indian Agriculturist* some very interesting papers on bamboo growth and cultivation, from which I extract the following:— "In Feb., 1876, experimental plantations were ordered to be established by the Government of India for the purpose of testing the cultivation and cropping of bamboo; and in a "memorandum" officially issued by Dr. Branlis, then Inspector General of Forests, he directed attention to the main points to be determined thereby, pointing out clearly "that the

experiments undertaken *should be as much as possible comparative*, of a number of clumps of the same ages and species and growing under the same conditions, *some should be thinned lightly, others heavily, and the third group should be cut completely, leaving only a few old stems on the ground.* To cause it (the bamboo) to produce an abundant crop for many years the sprouts must be cut some distance from the ground. If they are cut on a level with the earth the plant would be entirely ruined, perhaps because the shoots being stripped would no longer be preserved from the burning rays of the sun, or because the branches and the leaves which grow in abundance round the foot of the plant cannot receive nourishment any longer from the air, and have therefore none to furnish the roots. This is how the bamboo is treated in China for the manufacture of paper. With the Chinese this has long been a flourishing industry, and it is to be hoped that the experiments made in India may tend to the same industry being firmly established in the country.

In China the bamboo stems are steeped in large water tanks, constructed in the fields for that purpose, for some time, lime being added to the water in which the stems are soaked. When sufficiently soft they are taken out and beaten on stones to remove the flinty matter always found around their stalks.

Dr. Hooker observed when in the Himalaya, a similar manufactory for making paper from bamboo stems; the method pursued being precisely the same as in China, *i.e.*, steeping in a solution of lime, and then beating on stones till soft.

Mr. Routledge, having had practical experience in the process, has published a pamphlet, "Bamboo Considered as a Paper Making Material," the paper used

for printing it being manufactured from bamboo stems. And the *Paper Makers' Monthly Journal* is printed at his works from young bamboo stems of the season's growth, which were collected for him by order of Government in British Burmah, he having paid at the rate of 150 rupees per 1,000 for these stems delivered at Rangoon. They were floated down 120 miles from the Pegu Forests. In a letter to the paper before mentioned, he writes, alluding to these young stems he had used for paper—"Unfortunately, after being crushed they were sent home to me as dunnage—*unpacked*, and thus contracted a large amount of dirt, which, once combined with the fibre, it is difficult, if not impossible, to eradicate. This, however, would obviously not occur if the bamboo stems were converted into stock in a regular factory when received. "I may add also that although even from the native jungle, practical evidence has thus been given that the young season's stems can be delivered within the cost of five shillings per ton, as also that they will float. I am satisfied that greater economy of cost as well as greater certainty of quality would be ensured by following the system I have always proposed of regular plantation under irrigation.

"I have converted some tons of this bamboo into stock, which will pack into compact bales, measuring about 50 feet to the ton, and the yield of this per ton of raw dry bamboo exceeds 70 per cent., a greater yield than from any other fibre I have hitherto treated. I may also state that after subjecting the dried, crushed, raw bamboo to two tons pressure per square inch, I have failed to get it into a less bulk than 125 cubic feet per ton weight, thus proving that raw bamboo can never become an article of export.

"Having thus passed the Rubicon, that is the experimental state, and converted some tons of Indian

bamboo into paper stock, and paper of good quality, I am able to vouch for what some cavillers might say I have hitherto only theoretically asserted."

Esparto grass (the raw material on which at present the paper trade mainly depends) has risen ten shillings per ton, with the general rise in prices recently set in; now, therefore, would be the time to push the bamboo enterprise forward, especially as it is asserted to be "a material infinitely superior to esparto," and the stock producible at less cost. The bamboo in India is practically inexhaustible; as though in certain localities it dies out, there is always a young growth coming on, and plantations could soon be established, if its properties as a paper-making material bring it more before the commercial world.

Besides the plants already named from which paper can be made, the following fibrous substances may also be mentioned, as they have from time to time been applied in India to the manufacture of paper, and also experimented with in England:—

Agave Americana, fibre and tow.
Anassa sativa, half stuff.
Bauhinia purpurea, fibre.
Bhassaba paper, raw material.
Bœhmeria puya, tow.
Bœhmeria nivea, rheea tow.
Broussonetia papyrifera, bark.
Calotropis gigantea, mudar tow.
Corchorus capsularis, half stuff.
Crotolaria juncea, half stuff.
Daphne cannabina, pulp.
Guatteria longifolia, fibre.
Guazuma tomentosa, fibre.
Gyeegywoh-shaw, Burmah.
Hibiscus fibre, half stuff.

Hibiscus cannabinus, half stuff.
Jute (red), half stuff.
Jute (white), half stuff.
Jute (red), tow.
Morus indica, fibre.
Musa textilis, fibre and tow.
Pandanus odoratissimus, fibre.
Puya bark.
Shaw-nee, *Shaw-young*, *Shaw-labway*, Burmah.
Sterculia urens, half stuff.
Urena lobata, half stuff.
Urtica neterophylla, tow.
Yucca gloriosa, fibre and tow.

Various papers of different sorts made from the above named plants, as well as specimens of the plants themselves, were exhibited at the Vienna Universal Exhibition of 1873; a full account of them will be found in Dr. Forbes Watson's Catalogue of the Indian Department, from which I have taken the list given.

CHAPTER XXII.

POTTERY.

CONSIDERING the rage for pottery and china of all sorts and kinds in England at this period, it is extraordinary that Indian Pottery is not more sought after. In Paris since the Exhibition a good deal of interest has been excited amongst the curiosos of that city; but with us nothing but Chinese and Japanese pottery is thought worth notice, that is of the productions of the most distant countries. Much of the Indian work really deserves attention: for example, the glazed pottery of Scinde and the Punjâb; the unglazed and pierced pottery of Madura; the red earthenware of Travancore and Hyderabad; the red glazed pottery of Dinapoor; the various kinds of painted ware of Kotah, and the gilt and black, black and silver potteries of different parts. At the Paris Exhibition only the pottery made at Azimghur and in Scinde, and specimens from the Bombay School of Art were to be seen. At the Vienna Universal Exhibition of 1873 a selection of earthenware from various parts of India was exhibited. Casts, scroll ornaments, flower pots, goglets, cooling pots, cups, teapots, &c., from the Madras School of Art; black pottery from Sewan, pottery from Umroha, coarse porcelain from Lahore, black and red goglets from Baroda, ancient bricks

from Tatta, and the ruins of Bumboor; ancient tiles from various tombs glazed and unglazed, plain and with patterns; pottery from Berar, besides specimens of the different substances used in glazing and colouring, such as "sendoor" (red lead), and "lagwarde" (lapis lazuli), "dha" (earth) red and black, "moordarsing" (litharge), "sahree" (clay paste), "waree" (sand) and "cashee-jo-rung" white glazing composition. But almost all over India here and there artistic bits of earthenware are to be found; the shapes of even the most common jars and pots are artistic, even the huge water gurrahs have a charm of their own for lovers of such things. Frequently have I been struck with quaint little pieces of ware, and should have become the possessor of many a specimen, only I feared the rough journeys would break such treasures before I could bring them home. The potter's art is in India of the highest antiquity, and in the country villages the water vessels which are made in most of them are still thrown from the wheel in the antique forms, which are to be seen in the old Buddhistic sculptures and paintings. Very few colours are as a rule to be observed in Indian pottery, and dark and light tints of the same colour are the most usual style of colouring. The designs are mostly in outline, with no shadows. Some of the early specimens of pottery are said to be identical in character with the vases found in the Etrurian tombs, dating from about a thousand years before Christ. Dr. George Birdwood gave a lecture in the early part of last year, at the Society of Arts rooms on Indian Pottery, which was most interesting. In it he dwelt on the antiquity of the Art Pottery of India, and described the technical details of the manufacture. In Peshawur there is a kind of earthenware made which is, I believe, only to be found in that city, and the whole process

CHAPTER XXIII.

RYOTS.

THE Indian ryot is a thorough conservative; he will have no change from the manners, the customs above all the agricultural superstitions, for they can be called by no other name, which have come down to him from time immemorial: in the old grooves in which his ancestors run he will run, in those grooves he is by no means a bad farmer, that is as far as the light he has, takes him; but run him off the old line, and he is undoubtedly stubborn, indolent and apathetic, he fails to see the use of such and such a thing,—it has always been done in such a way, why alter it now? Why attempt subsoil drainage or grow fodder for cattle? Why use new kinds of manure? Why plough so deeply? It may not be that in reality he is too stupid to see the good of such measures in an exhausted soil; in fact, nearly always it is because he fails to see where money is to come from for such improvements, when as it is he can barely keep himself alive and pay his rent.

The ryot has too often been called improvident, reckless, thriftless, spending more than he gets, be his incomings large or small. This is quite a false idea, and is calculated to give a totally wrong impression of the mass of Indian small agriculturists. That he is too often sunk in debt is hardly his fault; he must

sow his land, he must pay his rent. He has no capital, he must therefore borrow; and borrowing he [illegible] of the village money-lender. He ties the noose around his neck, the knot of which is drawn tighter each year, until he finds himself the slave of the usurer.

As a rule, village husbandmen are simple, honest, contented, and peaceful; when their harvests are good they rejoice, when a drought takes place and their crops are small then they are ill at ease; but, take their average state of toil and hard work day after day, month after month, year after year, the only wonderful thing is that they are so patient under their troubles. If the ryots could be taken out of the money-lenders' webs, and shown how to steer clear of these rapacious harpies' toils, there is not much fear for their future.

The ryot

> Wants but little here below
> Nor wants that little long.

Given sufficient for his wants, he will [illegible] debt; but his land is [illegible] his cattle; if he [illegible] land, he must perforce borrow money [illegible] too often at a ruinous interest. The [illegible] ryot is a creature of few needs. His [illegible] consists of a few huts built of [illegible] mud, floored with the same, and thatched with jungle grass. He has little furniture, [illegible] —a bed of sacking or [illegible] more likely he sleeps on a mat [illegible]. Dried mud is a great feature in a [illegible] ment, his hut is daubed with [illegible] of it, also his fire-place. He will [illegible] brass cooking pots; but very likely [illegible] *chatties* and *gurrahs* made of [illegible]

ware, but of world-old shapes. His womenkind keep the hut clean and dress the food, two meals a day being the average allowance, consisting of rice, *dhall* fish, if procurable, and chillies. Plantain leaves serve for plates. The women also spread the seed to dry, husk the rice, and often labour hard in the fields too. The babies, of which in an Indian village there always seemed to me to be swarms, tumble about without a vestige of clothing, perhaps a string round their waists—merry little creatures, with preternaturally large eyes and (pardon me) stomachs. The ryot himself wears little beyond his dhotee and his turban; his clothes cost him little; his house rent is from 1 to 2 rupees; the homestead, if he did not build it himself, will cost from 30 to 35 rupees for the biggest mud hut. He usually keeps a pair of bullocks, which would cost from 20 to 30 rupees, perhaps less. His plough he has very likely made himself, and at the outside, taking into consideration its being shod with iron by a blacksmith, it will not cost him more than 1-8 or 2 rupees. It will be seen that with such an establishment, should any unforeseen calamity occur, the death of his cattle, or a bad season, and the consequent failure of his crops, his rent falls in arrears, and he is obliged to borrow to buy seed for his next sowing; the *mahajan* thinking nothing of charging him 40 or 50 per cent. interest. Food to the ryot is his heaviest item of expenditure, 8 rupees per month would probably cover it; keeping his family that time in their simple food: but even to secure such a paltry sum the bread-winner, or rather grain-winner, has to work "from morn till dewy eve," a hand-to-hand struggle, really speaking, for life. If it were not for the climate, and the way the poorer natives have of living and even being, comparatively speaking, healthy on the barest possible subsistence, the ryots

must knock under completely to the force of circumstances, circumstances over which they, poor creatures, have little or no control; but which might be amended very considerably by a judicious looking into of their state on the part of Government. The patience of these Indian cultivators under oppression and misery deserves a better fate than that they should die off by thousands in times of famine like rotten sheep, without a murmur, unless it may be of "*kismet*" as they pass away.

The land tenure of India, one of the most complicated systems in existence, has grown each year more oppressing to the ryot. It has literally hemmed him in, sunk him more deeply into debt each season, and landed him in a state of misery beyond which it is almost impossible to imagine a lower depth. I speak of the smallest ryots; those with more land are possibly in a higher condition, but even to them ruin must come eventually if the common cause of the Indian ryots is not taken up in places of authority.

Three-fourths of the people in India depend entirely on the land for subsistence; and that, with the deplorably backward state that agriculture is in, is a very serious matter.

The exact number of separate centres of population, cities, towns, villages, &c., in British India, including Burmah, was ascertained by the last census returns to be 493,466. If we take the accepted estimate of 200 millions as the population of the country we get about 400 people to each centre, some 448,322 of these centres are returned as having less than 1,000 inhabitants; and it is not at all unreasonable to suppose that the inhabitants in nearly all these 448,322 villages depend for their living on agricultural employments. It is, therefore, not too much to say that out of the 200 millions of souls in India, nearly 1[illegible]

millions gain their living by the land. All the ryots holding a few fields depend on those fields for their little all. In times of drought, then, it is not difficult to fancy how much they suffer. They lose their crops, they lose their cattle, and they fall in debt. Colonel Virtue, with regard to those ryots holding more land than they could properly cultivate, made a suggestion in the *Indian Agriculturist*, some months ago. It was that ryots should be encouraged to plant a smaller area, but to spend as much labour and manure on the smaller area as they did on the larger. Suppose a ryot to cultivate 50 acres and to spend 24 rupees per acre, this would represent, including the value of his own work and that of his cattle, 1,200 rupees. If he spent this same sum on, say, 25 or 30 acres the result would in the end be infinitely more beneficial to him than if he cultivated poorly the larger area. There would be a saving in seed, in irrigating expenses, in fencing and in watching crops during the time of ripening, while the 20 or 25 extra acres would be left fallow, and could be used for grazing, grazing land, like manure, being a crying want in India. Under such a system each acre would cost, instead of 24 rupees to cultivate, about 40 rupees, the difference, 16 rupees, being spent on the land in deeper ploughing and more generous manuring, resulting in heavier crops of better quality. If the large ryots could be made to see the wisdom of such a system, and that their own immediate interests were concerned in it, this suggestion, which is on the face of it evidently practicable, might be carried out with immense benefit to the country. But the question is, how is the prejudiced cultivator to be made to see his interest in such a change of method? The following plan of opening his eyes is suggested by the *Indian Agriculturist*:—" Government has ample means at its disposal to

try this experiment. The estate under the Court of Wards will be found most suitable for this purpose. Let the manager of these estates select four intelligent ryots, and ask them to try the experiment on small plots of ground about four acres each, at the same time guaranteeing them against actual loss. This would not lead to an extensive risk on the part of the estate, and would give the experimentalists confidence. Steps would have to be taken, of course, to see that extra labour and manure were actually expended, and we feel convinced that the second year would show highly satisfactory results. Granting this the ryot might then be left to himself to follow it up; and this he would do, as self-interest is the spur that will push him on if anything will."

In years gone by the rudeness and inefficiency of Indian implements of husbandry and Indian methods of cultivation did not so much matter, because the soil was more fertile, and the seasons of drought less frequent, the Indian plough, which merely scratched the ground, the "field after one ploughing," as Dr. Tennant informs us in his "Indian Recreations," "frequently appearing as green as before; only a few scratches being perceptible here and there, more resembling the digging of a mole than the work of a plough;" but this "scratching" was then sufficient to clothe the fields sown after it with richer crops than are now procurable from the soil.

It is a mistake to suppose, however, that in those days the ryots never manured their lands at all, because they used leaves, wood ashes, and ordinary manure; now that wood is so dear for fuel they use up the manure they formerly were able to spread on their fields for fuel; and even the wood ashes, which were largely used by some natives on their land, they cannot now procure, without buying the wood for fuel

first, which they are too poor to do. If they could obtain firewood they would not use the valuable *ooplá* as fuel, but give their ground the benefit of it, as they formerly did. Their fields can do without manure, but they cannot do without food, which must be cooked; and so the villager, not being able to get firewood, uses his cowdung cakes for fuel. Vegetable produce the natives do not value enough, and they burn up heaps of refuse which would, in the absence of other more enriching manures, help to invigorate the soil. This waste of vegetable matter ought and should be stopped as much as possible. Again, they do not understand, or very few of them do, the value of rich marl, which is to be found at the bottom of many of the shallow lakes and ponds. Often these lakes run partially dry, or in some cases the water might be run off, that is where springs feed the lakes, and they can be re-filled, and this marl had for the labour of digging; mixed with artificial manures it would be invaluable, and even used as dung on the land, it must have a fertilizing effect. Here, again, India cries out for help to assist in developing her agricultural resources. It would be the duty of a Department of Agriculture to look into all these details to prevent vegetable waste, to use the natural aids for increasing the fertility of the soil, to prevent exhausting crops being too often grown on the same ground, to plant useful trees, and those valuable grasses which promote *humus* in the soil; in fact, as I have said elsewhere, to help the ryots to help themselves. To aid them in their dealings with their oppressors the *mahajans*, by advancing at reasonable rates of interest the money necessary to buy seed to harvest their crops, by lowering the assessments on those lands which they have planted with trees of their own accord, or dug wells in, or otherwise

materially improved; to show them practically, in the manner suggested by Colonel Virtue, the folly of cultivating more land than they can really do justice to and tend properly; in fact, in a hundred and one ways to show that interest in Indian agriculture which we are now reaping the fruits of having so long neglected. The wealth of India is in her land; and while we refuse to interest ourselves in the great question of agricultural wealth, we are simply neglecting our own financial interests. If anything will lift India into the place she should hold in the world, it will be by increasing the fertility of an already fertile soil, no such very hard matter, one would fancy, when "nine-tenths of it (excluding Lower Bengal) is the property of the State," and a full rent can be levied on it, which can be periodically enhanced as the land is enriched to bear it. It is the old story so often quoted of the bird and the golden eggs. We have our bird, it has laid golden eggs, but if we do not feed this mythical fowl, it cannot be expected to continue laying, and we starve it by withholding assistance when and where it is needed, and yet expect to hear the joyful cackle announcing fresh acquisitions to us in the egg line. We put the fault of the poverty of the land on the unhappy ryot's shoulders, say he is this, that, and the other, expecting, like Pharaoh of old, to have bricks made without straw, "Go ye get your straw for yourselves," i.e., produce crops without aid from starved ground; and "diminish not ought from the tale of bricks," i.e., continue to pay rent and taxes as before.

Oh! We need a reform in Indian agriculture more than most people think, and we need, as Mr. Hume says, an Agricultural Department in India, "firstly, to ascertain precisely what reforms are essential in our existing agriculture as practised in various

parts of the empire; secondly, to work out systematically the best methods of carrying through these reforms."

Good government means, we often hear, the "greatest good to the greatest number." In helping the agricultural population of India this axiom would be carried out: at least 70 per cent. of the population derive from agriculture their daily bread, depending on it for their living, while if its power is considered indirectly it may be stated that the entire population are more or less influenced by it. All the various industries are in a measure connected with it, and draw their power of continuance and prosperity from the soil. The revenue is sensibly affected by good or bad seasons, thus proving how much it depends on the flourishing state of the land. It is, therefore, no trifling and minor matter which should engage the attention of the Indian Government, but an inexpressibly momentous one. But the Government looks at these things from a purely fiscal point of view, and so very very little are their importance considered that the necessity for *economy*, about which lately so much has been said and written, has led to the abolishment altogether of the Department of Agriculture, which, though far from being in any way adequate to India's needs in this particular, was at least a step in the right direction, and might in time have developed itself into a practical working centre, round which those interested in this vital question could rally. If to attack one of the most useful departments—though not nearly so useful as it might have been made—and to all intents and purposes to abolish it, is one of the first steps in this mighty scheme of paring down and retrenchment, where will the movement land India?

CHAPTER XXIV.

SEEDS.

UNDER the head of "OILS" I have treated of linseed, poppy seed, and *til* or gingely.

RAPE SEED

Is exported from India in large quantities. More than half our supply of this seed as early as 1867 came from India; for in that year we imported 620,782 qrs of rape seed, of which 429,134 qrs. were shipped from Indian ports.

The marked decline of Russian seed caused last year a large increase in the Indian exportation of rape seed, as also with linseed. The following are the quantities of the former which have been exported during the last five years:—

Year.	Cwts.	Rupees.
1873–74	359,854	16,19,335
1874–75	827,430	37,23,429
1875–76	2,241,843	1,08,48,208
1876–77	2,088,760	1,14,29,244
1877–78	3,193,488	1,91,84,378

The increase in the last named year being more than 1,100,000 cwts. Rape (*Brassica napus*, Linn.) is, as will

be seen, now very largely cultivated in India. It is a biennial plant of the turnip kind, the woody root is hardly fit for food, it being grown for the sake of its seed, from which the oil called Colza is expressed. In England sheep are fed on the leaves of the plant, as also on the cake made from the oil.

MUSTARD SEED.

The seeds of the *Sinapis juncea* (Linn.), or Indian mustard, are possessed of the same properties as black and white mustard, and they can be employed for the same purposes. The plant is greatly cultivated all over India, and our imports of this useful condiment are chiefly brought from India and Holland. When the seeds are deprived of their oil they are more pungent, but their pungency does not last long for medicinal purposes; therefore, the freshest seeds are the best. It is said that mustard was not known in its present form, *i.e.*, in a powder in England, until 1720, a Mrs. Clements, of Durham, being the first person to discover that the seeds should be ground in mills to a powder or meal. The natives value the oil expressed from the seeds very highly, and use it as a rubefacient, it being supposed to invigorate the body when well rubbed in. Since the year 1874, the exportations of this seed from India have decreased, as the following figures show.

Year.	Cwts.
1874	15,011
1875	1,193
1876	12,770
1877	5,435
1878	7,782

The seeds of other sorts of Sinapis are also used in the manufacture of mustard, the *S. ramosa*, *S. glauca*, and *S. dichotoma*; and the oil expressed from these plants is also much valued by the natives.

Taking the total quantity and value of the Indian seed exports, including all kinds, it will be seen from the figures quoted from Mr. O'Conor's report that the last year was one of very considerable activity in the trade, it being favoured by fair crops in the North West Provinces and Central Provinces, the decline of the Russian trade in seeds also assisting it.

Total exports of seeds from India for the last five years:—

Years.	Cwts.	Rupees.
1873-74	4,433,270	2,36,14,508
1874-75	6,074,756	3,23,59,503
1875-76	10,506,822	5,46,19,818
1876-77	9,582,865	5,31,91,240
1877-78	12,187,020	7,36,02,837

There are some who view with dismay the increase in the seed trade, and possibly, in the present state of India's soil, with reason. The trade has increased in value from £3,850,000 in 1857 to £13,560,000 in 1877, something like 274 per cent., and the seed exports now constitute about 23 per cent. of the entire exports. These oil-yielding seeds are exhaustive crops to grow; far more of a drain on the soil than cereals, for from oil-seeds, opium, sugar, tobacco, &c., the soil gets little or nothing back; from indigo, notwithstanding the outcry against it some little time ago, there are some returns to the land in the shape of refuse plant, and indigo water, which both act as fertilizers; besides, indigo is cut green, and being a legume, its leaves absorb ammonia, and land on which it has been grown

is enriched with nitrogen. Too much of this exhaustive seed growing is impoverishing to the land, which certainly does not need to be made more sterile; and though it may be for a time beneficial to the revenue, is likely to bring disastrous after effects. If grown in proper rotation on land, not starved, but enriched with natural and artificial manures, oil-seed growing is all well enough; but under the ryot's present system of "spoliation farming" is no doubt productive of more harm than good.

CHAPTER XXV.

SILK.

It is to China that we are originally indebted for the knowledge of the manufacture of silk from the silkworm. This art was brought into Europe by two Nestorian monks, natives of Persia, who penetrated as missionaries into China. There they, according to the accepted early history of the silkworm, became acquainted with the rearing and general management of the insect. On their return to Constantinople they explained what they had seen to the Emperor Justinian; and he, becoming deeply interested in the history of the new art they gave him, sent them back into China to become more thoroughly conversant with the silk manufacture as carried on in that country, and, if possible, to procure some eggs of the *Bombyx mori* or silkworm moth, with which he might experimentalise in his own empire. By stratagem these monks obtained some eggs, which they hid in the hollow bamboo walking sticks they carried, and brought them in safety to Constantinople. The eggs were hatched out in a dunghill, the worms fed with their usual food—mulberry leaves—and they throve and multiplied very rapidly. This is the first we learn of the introduction of silk into Europe. The author of "Periplus of the Erythræan Sea" writes of the Malabar silk as an article imported from the East;

but it is not probable that the method of obtaining raw silk was known in India till quite three hundred years after its introduction into Europe.

Aristotle is the first Greek author who mentions the *silkworm*, which he does in his "Natural History" v. 19, other writers supposing silk to be a vegetable production. Dionysius, writing of the Seres of Serica, by which name the Greeks called the silk-producing country, distinctly says that the "glossy down" was culled from flowers; and Virgil also supposed that the Seres carded silk from leaves. For at least six centuries the breeding of silkworms in Europe was known only to the Greeks of the Lower Empire. Sicily had the art transferred to her in the twelfth century. In the thirteenth it was introduced into Italy, and from thence spread into France and Spain. It was not until the fifteenth century that the method of manufacturing silk became known in England. James I. did all he could to promote the breeding and rearing of the worm, and the culture of the mulberry for its food amongst his subjects, but with very little success. His introduction of sericulture into the English settlements in America for a time seemed in a fair way towards being established with success. The climate was favourable to the experiment, but the cost of labour prevented its being remunerative, and so it died a natural death.

It is very generally known that the Bombycidæ, a family of the order Lepidoptera, belonging to the section *Lepidoptera nocturna*, are the silk-producing moths which assume the pupa state in cocoons which the worms when about to change their state spin for their protection during their transition from caterpillars to moths. The *Bombyx mori*, the moth to which the silkworm turns, is the best known of the species, as being the most useful and interesting.

But [illegible]
come [illegible]
found in [illegible]
more [illegible]

The [illegible]
from [illegible]
a [illegible]
deeper [illegible]
caterpillar [illegible]
lighter.

The [illegible]
in arriving [illegible]
times. [illegible]
skin, it [illegible]
quiescent [illegible]
body slightly [illegible]
are periods of great [illegible]
worms which [illegible]
management [illegible]
in great [illegible]
forepart [illegible]
wriggles [illegible]
one spot. [illegible]
hind legs. [illegible]
the tail. [illegible]
Then it [illegible]
period of [illegible]
begins to [illegible]
fixed. It [illegible]
it to other [illegible]
the head being [illegible]
the silken threads. [illegible]
in body than [illegible]
about five days [illegible]
the worm hidden from [illegible]
of yellowish silk about the [illegible]

the cocoon the chrysalis remains quite torpid from a fortnight to three weeks. It then eats its way through its case and emerges as a winged moth; it pairs, deposits its eggs, and then soon after dies. The male moth also perishes very shortly after his short-lived mate. Silk cultivators do not allow the moth to eat its way out of the cocoon, because in doing so it of course by cutting through the silk spoils it for reeling—though it can even when eaten through be spun—they therefore kill the chrysalis by plunging the cocoon into hot water or else exposing it to the rays of a hot sun.

The exact period of the introduction of the domesticated silkworm into India has never been clearly fixed; and from the name *desi*, or indigenous, being applied to the oldest species known in the country, the fact that the insect was really imported in the first instance appears to be now lost sight of. Those who are much interested in sericulture should read in full the account of the Indian silk trade given by Geoghegan in his "Silk in India," from which I have drawn largely for my information. Writing of the trade in Bengal, the author of the above-named work says that in the early days of the silk trade in India silks were imported chiefly from China, Japan, Siam, Cochin China, and Persia, and that these importations were held in far greater estimation than Bengal or home-raised silks.

In 1710 a new species of worm was introduced called *bara palu* or large worm—the *Bombyx textor* of Captain Hutton. This was brought either from China or from some of the countries bordering on it. This breed has, unfortunately, like so many others, degenerated, and even in 1796 could not bear comparison with what it was when first imported. In those days silk was cultivated in much the same

regions it is at present in Bengal. [illegible] of Rungpur, Dinagepur, [illegible] what is now called Maldah, [illegible] Birbhum, and parts of [illegible] rah. The [illegible] Rungpur, Dinagepur, [illegible] Midnapur, Rungpur, [illegible] manufacture of [illegible] been for ages [illegible] tries were then connected with the silk manufacture, as they are now:—

1—Growers of mulberry.
2—Rearers of the worm.
3—Reelers of silk.

And the worms reared were of three kinds:—

1. The large [illegible] Bombyx textor.

2. The [illegible] Bombyx fortunatus, a [illegible]

3. The [illegible] there are said to be [illegible]

The food [illegible] leaves of the Morus Indica.

The silk [illegible] not much in demand, [illegible] badly reeled, and the [illegible] skein "it was common [illegible] double, treble, and in many instances [illegible] The mode of [illegible] the article had fallen [illegible] Richard Wilder [illegible] ments in winding; and [illegible] inducements to [illegible] berry on their lands, allowing [illegible] or waste lands, and permitting [illegible] hold them rent free for two years, and at [illegible]

gunnah rates for the third year. These regulations increased the rearing of the worm and the cultivation of the mulberry, but the silk was still too badly reeled to be in active demand. The Italian method of reeling was then introduced by Messrs. Aubert, Robinson, and Weiss. The first named gentleman died on the way out, but the others carried out to the best of their power the intended improvements, the results being so far satisfactory that from 1776 to 1785 a considerable and steady increase took place in the exportations, the Bengal silk at that time driving all competitors, except China and Italian silks, out of the English market. Greater attention, too, was now paid to the breeding and feeding of the silkworms; the degeneracy in the worms, which caused great anxiety to those interested in sericulture, was traced in great measure to carelessness in these particulars. Dr. Roxburgh, a great authority on such subjects, in a letter to Government, urged the necessity of great attention being paid to the worms' food. He writes:—"Improper food may be the sole cause of degeneracy, if such has really been the case; and I think it corresponds with the habits of the natives, who bestow as little labour on their husbandry as they possibly can; and without much care, constant attention, and labour, the Indian mulberry plant, as well as that of China, soon becomes stunted, and though not absolutely diseased yet unfit to yield leaves of the best quality. I would, therefore, recommend that much attention may be paid to the mulberry plantations, let the species or sort be what it may, for I well know that few trees degenerate so fast as the various species of this useful family. Another consideration of much real importance must be attention to freshness of the leaves when given to the insect; for though our domestic quadrupeds draw the best of nourishment

from dry food, yet I believe the caterpillar of the silk moth will thrive best when fed with the freshest leaves gathered at a proper age, so as to suit the digestive organs of the little animals through their various stages."

The sort of mulberry liked best by silkworms has small dark leaves, rather thick, and from being so doubly hard to pick. It is called *Morus alba*, and has a white berry. It does well as a standard tree, as does also the *Morus rubia*, or black berry. The *Morus Indica*, or common indigenous mulberry, is the best for general cultivation in Bengal, and silkworms are very usually fed on it. It requires a light, rich, elevated soil. Clayey ground should be avoided, as no water should be allowed to settle round the roots of the plants. Mulberry plantations require to be renewed once in three or four years. By this practice a proper and constant succession of leaves is insured. Cuttings are also planted frequently, usually at the end of the rainy season, when they are set in rows three feet apart, and a space of from one and a half to two feet between the plants. The labour of keeping a plantation in good order, when once it is fairly started, is not very great. The plants want, when still young, earthing up from time to time, and the ground must of course be weeded and dressed with manure as often as necessary. The plants are generally cut about four times each year, and have their leaves stripped twice. The trees are not cut down until they are five years old, then they are cut to the roots and allowed to grow again for another five years, when they are finally rooted out entirely.

The other mulberry plants, besides those named, cultivated in India are the *Morus atropurpurea* of Dr. Roxburgh, the *Morus latifolia* Dr. Lush. mentions. *Morus serrata* so called by Dr. Roxburgh, *Morus*

nigra, *Morus multicaulis*, *Morus leptostachya* or *shah toot*, and *Morus sinensis*, all mentioned by Mr. Cope. Those ryots who cultivate mulberry plantations do not always rear the worms. Such cut and sell the leaves to breeders of the insects, who are not cultivators of the plant, charging for a basketful or *coopie* at the rate of three baskets, each holding about one hundred pounds avoirdupois for one rupee. The average value of crop per *beegah* (which is the third of an English acre) differs of course in different localities, about 8 rupees is a fair estimate, which deducting the rent of the land, or 2 rupees, gives a profit of 6 rupees per beegah. A mulberry plantation is not formed quite so easily, though, as people might fancy; there are many, very many, difficulties to contend with before satisfactory results can be obtained; there are many enemies to be fought against: grubs gnaw away the roots, deer damage the bark and leaves, caterpillars—not silkworms—destroy the leaves and young buds, and a species of *lamia* causes much damage by gnawing the bark and laying eggs, the grubs of which when hatched eat downwards through the trunk, causing the tree to become sickly and die.

After the plantations are found and fairly established then rearing-houses for the worms will be the next consideration. These should be raised close to the plantation, so that quite fresh leaves can be constantly procured through the day and night. Silkworms are night-feeders, and it is quite necessary that they should, for their well-being, have fresh food at night picked straight from off the tree, not gathered hours before, and allowed to ferment by lying by until the worms require it. Such trouble as this a native will not give himself unless he is looked after; neither will he attend to another point on which equal attention should be shown, the cleanliness of the trays

on which the worms are kept. All wastage, refuse, &c., must be *daily* cleared away, dead-worms in particular should be removed directly they are discovered; putrefaction in such a hot climate sets in at once, and would be dangerous and unhealthy for the living worms. Silkworms are subject to diseases in all their different stages, in the egg, which is shown by its becoming discoloured; in the *larvæ*, also shown in colour, or in spots appearing on the body, or in jaundice, or in death in the cocoon when half spun, which ruins the silk, the worm becoming putrid inside it; and the *moth*, too, is subject to black spots, to a want of the proper secretion of the gum used in adhering the eggs when deposited to the substance on which they are scattered, and to unproductiveness of the eggs. Those accepted as authorities on sericulture trace all these diseases and ills to "improper food," and "improper management;" but "unsuitable climate, and the long-continued artificial system to which the insect has been subjected," Captain Hutton considers, are also answerable for the degeneracy of the silkworm at the present time." And the only remedies "he thinks that can effectually restore this valuable insect to health" must proceed partly from the introduction of a more careful and natural system of rearing, and partly from the periodical infusion of fresh stamina, derived from moths produced from eggs imported from the northern provinces of China, to which the insects are indigenous. By these means fresh strength and vigour may be imparted to the constitutions of our present worn-out and debilitated stock, the trouble and the expense incurred being amply compensated for by the improvement which must take place both in the quantity and quality of the silk."

The rearing-houses are usually from 24 to 26 feet

long, from 15 to 17 broad, and about 10 feet high; including the raised floor, which is perhaps 3 feet; the walls of earth, and the roof of thick thatch. The shelves are usually 16 to each *gurrah*, of which there are 5, each shelf having a raised rim plastered with buffaloes' dung; each shelf will contain about 3,200 worms, so that a house of this size would be capable of containing about 256,000 worms. The houses are also fitted with 10 *chandrukees*, spinning mats, bamboo chics for doors and windows, baskets of large size in which to carry the leaves, three or four gunnies for spreading on the floor, and a number of earthenware pots for different uses; the extra expenses are for extra buildings made of mats and thatch attached to these houses. The whole cost will be from 50 to 60 rupees for each rearing-house. The extra mat and thatch houses are for the *chandrukees* in which the worms are placed at night, for protection from the night air, and having the light of lamps the worms, while spinning, spin all night, and the cocoons from the unremitting labour are improved and the silk reeled from them of more even quality. On the cessation of the Company's trade with India in 1833, measures were taken by Government for the disposal of the silk factories as soon as possible; but it was not until 1837 that the severance was really completed, and the trade given over to private individuals. The number of basins in the filatures owned or occupied by the Company in 1831-2 is stated at 15,723; but these were either sold by auction or entirely given up. Geoghegan writes, "Since the silk trade passed into private hands in Bengal, Government has not taken any active measures for the promotion of the industry. Except, therefore, such figures as the Tables of Exports may afford, there is little to illustrate the history of silk in Ben-

from 1834 onwards." Many names of those erested in the progress of this industry can mentioned, *e.g.*, Mr. Bashford, Captain Hutton, . C. E. Blechynden, Messrs. Atkinson, Turnball, rshall, Signor Lotteri, M. Lagarde, M. Galloris, Perrin, M. de Cristoferis, Mr. Fox and Mr. Malm, besides many others, all of whom made experints in sericulture. The following table will show h what success:—

BENGAL SILK (RAW) EXPORTS.	
Period.	Average Exports in lbs.
1838–39 to 1841–42	1,384,242
1842–43 „ 1845–46	1,555,130
1846–47 „ 1850–51	1,290,024
1851–52 „ 1855–56	1,511,506
1856–57 „ 1860–61	1,511,768
1861–62 „ 1865–66	1,485,763
1866–67 „ 1870–71	1,558,246

ese figures are exclusive of waste silk and cocoons, ich were in 1870-71 for the first time exported. the present state of the Bengal silk trade "the ductions of *Bombyx* silk in the Lower Provinces cluding Assam) seems to be confined to the dis-:ts of Rajshahi, Maldah, Murshidbad, Midnapur, bhum, Hughly, Burdwan, Bograh, Howrah, Nuddea, sor and the 24 Pergunnahs." The first named : are the chief silk-producing centres, the others ng some of them of but little note, and in the e of Nuddea and Jessor only having one filature each district. In Rajshahi, on the contrary, Mr. ine, the assistant magistrate, says that there are less than 97 filatures, 34 of them being owned

by Europeans and 63 by natives, containing a total of 5,760 basins, and employing from 11,000 to 12,000 hands. The yield of raw silk this gentleman estimates at 5,000 maunds; and he considers that the area under mulberry cultivation is about 150 square miles, while at least a quarter of a million of people are supported, in one way or another, by the trade in this district alone.

In Bombay the earliest attempt at sericulture was made by Mr. Baber in 1823, who introduced worms from Mysor into the Southern Mahratta country, experiments being tried successfully at the Dharwar Jail.

Silk was introduced into Khandesh in the year 1826, by Mr. Giberne; but the results of the experiments were very slight, and in 1838 were quite abandoned. The Ahmadnagar silk industry also proved a failure, as did also the Gujrati experiments. Signor Mutti was in 1838 appointed Superintendent of Silk Culture in the Deccan; but though Government spent large sums of money on the effort, and at one time great hopes were entertained, the result proved that Signor Mutti had been too sanguine and not sufficiently careful in his method of superintending the work; and failure was also the result of this experiment. And the Bombay Chamber of Commerce writing under the date of the 28th December, 1871, says that there is "no production of silk in any portion of the Bombay Presidency." At any rate, there is no export trade in the article. All the silk used in the Bombay manufactures being imported chiefly from China, not much Bengal silk being used, two descriptions of it are imported, "the Radhanugri, which yields chiefly Jumbolia, and Jadi or coarse-yielding Takra or Wana. Southern India appears to be well adapted to the growth of the mulberry and the rearing of the worm;

as yet but little good has resulted from the experiments hitherto made. In most of the districts in which sericulture has been introduced it has died away, except in Salem, Coimbatore, Cuddapah, North Arcot, Tinnevelly, and South Canara. In the Punjâb Dr. Gordon, in 1836, tried to introduce the industry at Umbala, but on his departure the attempt fell through. Colonel Wade at Lovdianah, Colonel Herbert at B[illegible], Colonel Abbott at Hooshyarpore, Mr. E. C. Bayley in Kangra, and Mr. Cope in Rawul Pindee, all commenced sericulture; but their efforts do not call for much notice, though they go far to prove that the silkworm can not only stand the climate of the Punjâb, but that the silk it produces is superior either to that imported from Bokhara or Khorasan; while of the mulberry, the common species is abundant, and the finer sorts flourish under careful cultivation. It is evident that with care as regards food, sericulture might be made a source of wealth to the Indian ryots in these districts, and also a source of profit to European speculators. In Gurdaspore the industry has not died out. Just lately the death of Mr. Halsey has affected the district; but though the season has been a bad one, the winter and spring having seriously damaged the leaves of the mulberry, the price obtained for unpierced cocoons is about 80 rupees per maund, and at this price there is for them a fair market, a native of Umritsur having purchased, so it was said, 10,000 rupees worth last year, and is leading men to collect cocoons in the same district this year also. It is a pity if the industry of this particular district, which is known under ordinary conditions to be favourable to sericulture, should be allowed to die out; and it is to be hoped that efforts may be made to increase it, and encourage the ryots to continue planting the mulberry and rearing

the worm. Mr. Halsey's filature at Sujanpur will, it is said, probably be purchased by a Bradford firm, and so be kept up. Captain Hutton strongly advocates Mussooree as a place well suited for silkworm culture, especially of those wilder sorts of silk-spinning insects which have yet to be mentioned; of which the Tusser or Tasar, the "Eria" and the Munga are the best known. The former is the most widely distributed silkworm in India, it is the species usually designated the *Antheræa paphia* of Linnæus; but there are most likely other moths also included under the head of "tusser," the insect known by this name is found in the Sub-Himalayan tracts, nearly throughout the whole extent of the range through the hills from Assam to Chittagong, also in the Soonderbunds, and in the forest and hill belts inhabited by the Sontal, the Kol, the Khond and the Gond, also in portions of the Madras Presidency. The tusser worm is multivoltine, and a much more indiscriminate feeder than the ordinary silkworm, for it feeds on the ber (*Zizyphus jujuba*) the almond (*Terminalia catappa*), the suma (*Bombax heptaphyllum*), the asun (*Terminalia alata*), the saj (*T. tomentosa*), the sál (*Shorea robusta*), besides other trees and shrubs. Dr. Henderson, Colonel Rowlett and Mr. Fretwell mention wild silkworms found in their respective districts, and Dr. Buchanan gives an interesting account of the rearing of the "tusser" and winding of its silk by the natives of Bhagulpoor. The tusser breeders in Madras are chiefly low caste men, such as Teloogoos and Gonds. The great difficulty which rearers have to contend with appears to be the wild state of the moth, which will not bear domestication. Out-of-door cultivation is therefore generally adopted, the worms directly they are hatched being placed on the trees on which they are to feed, the rearers watching the trees armed with pellet bows, to prevent the birds and hornets attacking them, the worms

being moved to other trees when they have exhausted the leaves of the first on which they were placed; they are also allowed to spin on the trees, and the cocoons when finished remain one week to harden; they are then taken down, the grubs within them killed by the cocoons being plunged into boiling water, and the cocoons either sold as they are, or else the silk wound off them by the rearers. The tusser worm takes very short sweeps of its head in spinning from side to side, so it draws its silk very closely in parallel threads which makes the reeling off even a more difficult process than with the common silkworm's silk. In Bhagulpoor women usually wind off the silk, as they do also in Burmah and Assam.

Next to the tusser worm in importance ranks the "munga" or moonga of Assam (*Antheræ Assama*) it is also found in the Dehra Doon. The silk it gives is of a fawn-colour, and in Assam it feeds on *Champa*, *Meizankury*, *Soom*, *Soonhalloo*, *Dilguttee*, and *Pattee hoonda*. The *Soon*, a species of laurus, appears to be the most suitable food for the "munza," as the finest silk is procured from worms so nourished. These worms are also reared on the trees in the same way as tusser worms, the trees besides being watched to prevent birds and hornets attacking the worms, have their trunks smeared with molasses, and dead fish are heaped at their feet to hinder ants from climbing up, as their bite kills the worms; bats, owls, wasps, ichneumons, and rats may also be reckoned amongst their enemies. To prevent their crawling away to other trees, plantain leaves are wrapped round the trunks of the trees on which they are, as they cannot travel over a smooth surface. In forming their cocoons these worms also spin instead of winding, especially when two or more cocoons are joined together, as is often the case. "The price of common 'munga' silk is from 3 to 4 rupees

per seer; but the better sort, mezan-kuri, fetches from 6 to 8 rupees per seer. Fifty thousand cocoons are estimated to yield upwards of 12 seers of silk, Mr. Hugon, however, puts the price at 5 rupees per seer."

The "eria" worm (*Attacus ricini*) has spread very little if at all beyond the province of Assam, and the Dinagepore, Rungpore districts south west of Assam; it feeds chiefly on the *Ricinus communis* and *R. viridis* of Willedenow—which plants are easily raised in free mixed soils; the latter plant is really red not green, viridis being decidedly a misnomer. This worm feeds and thrives best, Mr. Hugon tells us, on castor-oil leaves. There are seven broods in each year, the cycle in summer lasting from 43 to 47 days, in winter two months. The "eria" is more domesticated than either the "tusser" or the "munga," and is reared by the natives in their houses, the silk obtained is worth from 12 annas to 1 rupee per seer of sicca weight. Very little, however, of it comes into the market, as the natives rear and manufacture only enough for their own use; it is said to be most excellent material for wear, the life of one person being quite insufficient to wear out a garment made of it, so usually the garments descend from mother to daughter or even granddaughter. The Government of India, in Resolution I. of 28th February, 1879, para. 6, asserts that "there is at least as great demand in the European markets for the cocoon of the eria and munga worm as there is for that of the tusser." It should be noticed, further, that there is a use for waste and for pierced cocoons, as these when they cannot be reeled can be spun."

The *Attacus cynthia* is very closely allied to the *Attacus ricini*, some naturalists holding the theory that the latter is only a domesticated form of the first mentioned. Be this as it may, it is quite worth while

to cultivate this species, which is found throughout the greater part of the Himalaya, in the Dehra Doon, in Assam and Cachar ; it is a hardy worm moreover, and easily fed on the castor-oil plant, the *Xanthoxylon hostile*, the *Coriaria Nipalensis*, and other indigenous shrubs. Captain Hutton holds the opinion that it may be domesticated. The silk spun by this worm is at first glossy white, but changes to a dull sandy brown or grey colour. The *Attacus atas* is found in Mussooree, on the *Falconeria insignis*, *Bradleii ovata* and other plants ; also at Kumaon, where it affects the barberry. Captain Hutton speaks of the silk as "decidedly good." Among other wild moths of this genus may be mentioned the *Antherœa Perotteti*, found by M. Perottet, of Pondicherry, hence its name ; the *Antherœa Roylei*, found at Darjeeling, also in the Himalayas ; the *Bombyx Huttoni*, from Kumaon. *B. Bengalensis*, from near Calcutta ; the *Bombyx religiosœ*, from Assam ; besides *Antherœa Frithii*, *Saturnia sylhetica*, *Actias selene*, *Attacus Edwardsi*, and some kinds of *ocinaria* ; but little information of their silk-yielding properties is forthcoming, enough has been written though by men intimately acquainted with sericulture to show that the arts of silk manufacture and the rearing of the worms are those that need never languish in India, if only encouragement be given to natives to cultivate the mulberry and other varieties of food for silkworms and to rear more carefully the worms themselves. This industry, especially that portion of it connected with the wild moths, is open to much development in India, Assam, and Burmah ; the introduction of fresh stock to counteract the deterioration which causes so much anxiety, the more careful feeding and rearing of the domestic worm, and the greater attention which should be paid to domesticating those wilder species capable of being tamed, are all points to be strongly urged by

those who would see the Indian silk industry in a thoroughly flourishing state.

Unfortunately of late years the trade has been on the decline, and the information obtained since the date of Mr. Geoghegan's "Account of Silk in India" is but scanty. Silk reeling as a trade is largely practised in Bengal, where there are in the districts already named a great many European as well as native filatures. The average price of Bengal silk (raw) appears to have been, as declared at the Custom House on export, 6-4 rupees, 9-8 rupees, and 9-7 rupees, in each of the three last official years. China and Japan compete now considerably with Bengal in the matter of raw silk, and it rests with those who have, or ought to have, the interest and well-being of India at heart, either to allow this competition to go on, or, by encouraging by all means in their power the Indian raw silk trade, to prevent foreign countries from injuring the interests of our Indian Empire in one of her natural sources of wealth which is really at present lying dormant, but is capable of active development. According to Mr. O'Connor's recent "Review of the Trade of British India," the total quantity of raw silk exported from all India since 1856-57 is as follows:—

Period.	Annual Average in lbs.
1857 to 1861	1,636,206
1862 ,, 1866	1,345,515
1867 ,, 1871	2,342,070
1872	1,893,322
1873	2,231,578
1874	2,223,917
1875	1,656,015
1876	1,310,569
1877	1,417,893
1878	1,512,819

These figures exhibit very clearly the stagnant condition of the trade, which is, in fact, smaller now than it was twenty years ago.

The imports of raw silk into India exceed the quantity of Indian raw silk exported; but this, with India's resources in silk, ought not to be the case. The exports of piece-silk from India, for the last three official years, have been—

Year.	Yards.	Rupees.
1876	2,468,052	23,80,394
1877	2,376,126	22,26,985
1878	1,481,256	14,71,697

All these goods are pure silk, consisting chiefly of what are termed bandannas and corahs; also a small quantity of tasar fabrics. This trade is also in a declining condition; but, with proper encouragement, and a little speculation on the part of English firms interested iu silk manufactures, would doubtless improve, if really taken in hand, very rapidly. Government assistance and private venture must both be brought to bear, however, if any real good is to result to India from her silk industry.

CHAPTER XXVI.

SPICES.

BETEL-NUT.

THE fruit of the areca palm, or *Areca catechu*, is very extensively used in India by old and young, rich and poor, as a masticatory.

The tree itself is one of the most graceful of the palm tribe, growing to the height of from 30 to 40 feet; in a slender pillar with a smooth white bark, it, when backed by the darker shades of bamboos and dense foliaged trees, stands out in all its beauty. Dr. Roxburgh describes it as the most beautiful palm in the whole of India, and with reason. Its leaflets are about three feet in length. Flowers, small white and very fragrant, appear in April and May. The fruit or nuts which follow are the valued parts of the tree, and for their sake these areca palms are cultivated all over India. They are chiefly met with in Malabar, Canara, Mysore, Travancore, Northern Bengal, in Ceylon, and in the Eastern Islands.

The modes of preparing the nuts for mastication differ somewhat in different places. They are about the size of a small hen's egg, and when ripe of a reddish yellow colour; they are enclosed in a fibrous substance of a very fine nature, used by the Hindoos for several purposes. The nut has a bitter astringent

taste, and is never eaten alone, but mixed with the *piper-betel*, mentioned under the head of "PEPPER" and chunam. The nuts are gathered in August and September, but are not considered perfectly ripe until October. One tree produces from 200 to 300 nuts, and comes into bearing at the age of five years, continuing to produce fruit for twenty-five years; sometimes longer. In Travancore the nuts are prepared for use in this manner: they are collected while tender, stripped of the outer husks, and the kernels then boiled in water; during the boiling the water becomes quite thick, starchy, and red in colour; this gummy substance becomes by evaporation a sort of catechu, but far inferior to the real article. The nuts after boiling are sliced and dried in the sun, rubbed over with the gummy substance which was obtained by their boiling, and again dried; by this time the slices are black and fit to be used. They are also eaten in a whole state and when quite young, besides being mixed up with the other ingredients already mentioned.

The nuts themselves, when imported, are usually in the husks, but the chief trade is in the betel compound ready for use in the country itself; and of the great extent of this it is almost impossible to give any idea. It would hardly be an exaggeration to say that every other native you meet chews [illegible] so widely spread. The [illegible] of chewing, and a bright [illegible] but it injures the [illegible] of the teeth, [illegible] become black after a time. The [illegible] good if chewing is indulged in [illegible] as betel is allowed to be a [illegible] strengthener of the digestive organs, as well as the gums.

Even the [illegible] chewing betel; and when they [illegible]

nut, use the fruit of a wild species of palm, the *Areca Dicksonii*, which is found in many parts, particularly in the mountainous districts of Travancore and Malabar. Besides its ordinary use as a masticatory, it is used in the ceremonies which take place amongst the higher ranks, *betel* being presented on ceremonial visits and introductions: the omission of the business of betel presentation and chewing would, in many cases, be looked on as a positive insult. With so much use for this compound, it will easily be understood that the areca-nut, or betel-nut, is an article of considerable trade importance in Eastern countries, more especially since its consumption is universal, being confined to no particular class, but is in fact a national habit.

A large quantity are exported to China, Travancore being one of the chief places from which the prepared nuts are shipped, also to Bombay and other places. There were reckoned to be, according to the last survey, more than a million areca palm trees in Travancore. Ceylon and Sumatra are also large exporters of this nut. And the importations into Calcutta and into Canton from these sources are very great, Travancore alone exporting of prepared nuts from 2,000 to 3,000 candies annually.

CARDAMOMS.

This spice, which is exported largely from India, is the seed of different kinds of *Scitamineæ*. The *Elettaria major*, *Elettaria cardamomum*, *Amonum cardamomum*, and the *Alpinia cardamomum*, being the chief yielders in India and Ceylon of the spice.

"Grains of Paradise" was the name by which cardamoms were formerly known, though the cardamom proper and the *Amomum granum paradisi* are different varieties of the same natural order, and the

seeds of the last named are inferior in quality, though very similar. In commerce cardamoms are classed and distinguished by being named "Shorts," "Short-longs," and "Long-longs," the shape of the capsules leading to these distinctions.

The cardamom plant is indigenous in many parts of India, in the hilly parts of Malabar and Travancore, in Coorg, Nuggur, Wynaad, South Canara and other places. The various plants belonging to this order have a very wide range in the tropics, they being also found in Ceylon, Java, Sumatra, Madagascar, Western Africa, and Trinidad. The Java cardamoms are very inferior to the Malabar and Travancore, as are those grown in Madagascar and Africa.

In India, the mode of procuring them is to clear forest ground; this, however, requires to be done judiciously.

Cardamom plots should be formed by felling two or three trees, and clearing the undergrowth in the space so opened; and in from three to four months the plants appear, their seeds having been lying dormant in the ground; the weeds which spring up at the same time are removed, and the plants left to themselves to grow. In four years the plant has reached its full height, when it begins to yield fruit; it continues bearing well until its eighth year; in some places the stem is then cut down, and fresh plants spring from the stumps; in other places the plants continue bearing from ten to fifteen years, the fruit crop gradually lessening each year. At the end of the fifteenth year in Coorg, the plot would be abandoned, and the forest again allowed to overgrow it, the fresh clearings which have been made during these years having begun to yield full crops. Mr. Dickenson has lately written a paper on cardamom cultivation in Coorg, in which he says that the height and appearance of the cardamom vary in different parts

of Coorg; as the Coorgs now cultivate cardamoms they do not damage the forests; for, as he says, they understand well the danger of "killing the goose that lays the golden egg," which would be the consequence of clearing any large extent of forest for cardamom growing.

I have already mentioned the three varieties of cardamoms known in commerce: the *short* are the most coarsely ribbed and the brownest in colour, and are Wynaad or Malabar cardamoms; the *long-longs* are more finely ribbed and paler; and the *short-longs* only differ from them in being rather shorter and less pointed. The various shaped seeds are often mixed together.

The capsules, when ripe (usually in November), are carefully collected. The pods contain a number of angular rugged seeds, of a yellowish red colour, and very aromatic smell. This is more apparent in some varieties than in others, the capsules also differing a little in shape and colour. The general method of preparing for exportation is to dry the ripe capsules or pods over a gentle fire, and to rub out the seeds by hand. These are then dried in the sun, but must not be kept exposed too long, or their flavour will become spoilt; neither must rain be allowed to fall on them, as it would cause the seed-vessels to split. In some places in India, the growers of cardamoms raise them in gardens, and bestow considerable care on them, by which means the quality of the spice obtained is improved. As, however, the cardamoms grow so plentifully when left to nature, the carefully-nurturing process can hardly be said to answer; though, undoubtedly, cardamom cultivation might be, with advantage to the revenue, considerably increased without injury to the forests; for its growth is so spontaneous in the hilly tracts of certain districts that much of the cardamom

harvest is now simply wasted for want of gathering in. In the Travancore State, and in Cochin China, cardamoms are a monopoly; and a considerable amount of poaching is said to take place in those portions of British territory bordering on these States.

CASSIA.

Several species of cassia are found in India, and are all more or less cultivated, *Cassia lanceolata* being the best known; it furnishes the East Indian senna of commerce. There is no doubt but that the *Laurus cassia* might be cultivated without any difficulty in India and British Burmah, though it is now chiefly imported from China; the bark and buds being known as *Cassia lignea* and *Cassia buds.* The bark undergoes precisely the same treatment as cinnamon bark, which it, indeed, very closely resembles, in taste, appearance, and smell. It is not, however, at all difficult to distinguish the two; for cassia is thicker in substance, is not so much quilled, breaks off in shorter pieces, and is less aromatic, but more pungent. A good deal of *Cassia lignea*, or cassia bark, found in Indian markets comes from Borneo, Sumatra, and Ceylon. Malabar, however, produces a considerable quantity; but the Malabar cassia is of a darker colour, and much thicker than the Chinese cassia, and less thought of. The pulp, buds, and leaves of the different cassias are used medicinally. The seeds of the *Cassia auricula* are good in ophthalmic diseases. The *C. lanceolata* produces, as before mentioned, senna. *C. absus* is also used for eye diseases, the seeds being reduced to powder, which is introduced under the eyelids in very minute portions. *C. tora*, *C. sophera*, and *C. occidentalis*, are also all used in medicine in various ways;

applied externally or administered internally, their different uses being well-known to the natives.

Cassia is mentioned by very early writers; indeed, we need only refer to Holy Writ to find that cassia was in those days much thought of. "All thy garments smell of myrrh and aloes and cassia, out of the ivory palaces, whereby they have made thee glad," we find the Psalmist saying.

Dioscorides and Theophrastus (not Such) also mention the substance; and most writers consider it indigenous to India. It is not now, however, cultivated to the extent which it might be, considering the demand, in the United Kingdom and elsewhere, for it, whether in the form of *Cassia lignea* or cassia buds.

In 1866, according to McCulloch, the imports of cassia buds amounted to 78,048 lbs., they being worth, in the London market, about £9 per cwt. In the same year the imports of *Cassia lignea* were 349,449 lbs., and its price from £4 15s. to £5 4s. 7d.

CHILLIES

Are the fruits or pods of a variety of the capsicum species, called *C. frutescens.* The pods of the different capsicums are used as food in many countries. In India both the dried fruit, in the form of cayenne pepper, and the fresh fruit gathered from the plant itself, are both much used, the dried chillies being largely exported also.

Capsicums belong to the order *Solanaceæ*, and there are many varieties. *Capsicum annuum*, *C. fastigiatum*, and *C. baccatum*, supply the larger portion of the cayenne pepper used in commerce; *C. Nepaulese*, the Nepaulese pepper, so highly thought of; *C. fruticosum*, goat-pepper, very strong and pungent; *C. grossum*, bell-pepper; besides other kinds.

In India the fruit is gathered fresh or green; and, chopped up, forms an ingredient in curries, egg-toasts, and many other dishes. In taste the fresh and dried chillies are widely different, and to those who are well acquainted with the delicious flavour of the former, the pungency of the latter is by no means so agreeable. Eaten fresh, they are, in tropical countries, more beneficial, being great promoters of digestion. In our Indian garden we grew quantities of *C. frutescens*, or chillies, and not only used them fresh with vinegar as a mild sort of pickle, but cooked also with a variety of different savoury dishes. As a stuffing for quail they are invaluable, improving and drawing out the flavour of the bird.

In England it is almost impossible to procure fresh green chillies, though the fresh pods of the *Capsicum annuum* could, of course, be obtained from stove-grown plants; they have, however, little of the flavour of the true chilly, which has a delicate aromatic pungency with it, quite removed from the biting fiery taste of the English-grown capsicum. If hot vinegar is poured on fresh chillies, chilly vinegar is obtained, and this is not only a very excellent sauce to be taken with different kinds of fish, but a very good stomachic as well.

Cayenne pepper is prepared by drying the capsicums in the sun first, then in an oven, and then, when thoroughly dry, beating or grinding them to very fine powder; sometimes wheat-flour is added to this powder, and then cakes are made of the mixture, which are baked until they are quite hard, and then pounded, ground again, and sifted.

The best West Indian cayenne is made from the pods of the *C. baccatum*, and is imported ready for use, being prepared usually in the manner described. Capsicum-pods contain two distinct principles: "the one capsicin, an alcaloid; the other, an ethereal oil, which is

the stimulating principle; it resides chiefly in the external layers of the fruit and in the seeds."

The berries, or pods, after being bruised, are useful as strong rubefacients, in the form of a cataplasm. Cayenne pepper is also considered a good gargle in cases of sore throat; and is at times given internally as well, in intermittents, atonic gout, paralysis, flatulency, and general dyspepsia, in scarlet fever, and dropsy.

West India chillies are considered the best, fetching in London from 15s. to 25s. per cwt.

CINNAMON.

Though properly the trade in this article would come under the head of Cingalese industries, the cultivation of the cinnamon, *Laurus cinnamomum*, being chiefly confined to Ceylon, where this, the true cinnamon, is indigenous; still there are varieties of the natural order *Lauraceæ*, found in India, on the Malabar Coast, in Travancore, in the Concans, and other places, which so closely resemble the cinnamon of commerce that they are often substituted for it, and also bought with the full knowledge that the cinnamon produced from them is not the produce of the ordinary tree. The *Cinnamomum iners*, *C. nitidum*, *C. eucalyptoides*, *C. Rauwolfii*, all partake largely of the properties of the *Laurus cinnamomum*; the first-named is generally supposed to have furnished the cassia of the ancients; but of this there is little proof, their cassia being most probably the bark of the *Laurus cassia*, which is found in the south of Asia, and in China (see "CASSIA"). But there are so many contradictory statements about cinnamon and cassia, that it is useless to enlarge on the differences between the two, which are, indeed, but very slight. Cinnamon plants do not acquire any commercial value until they are full grown. In about six years after the young shoots are planted, they have grown to

about six feet, their full growth being from 30 to 35 feet in height; the tree has a smooth trunk, and is of graceful form. It throws out spreading branches, covered with dense foliage; the leaves are, when young, of a bright red and pale yellow, changing, however, very soon to green, which with age darkens to a deep olive; in form the leaves resemble the leaf of a bay tree, only a trifle longer and rather more narrow. The flowers appear in January, growing in clusters at the extremities of the branches, they are white in most of the varieties, with a reddish brown centre; these are followed by berries, one-seeded, and about as large as peas, only not round, but oval; when quite dry these berries are mere shells, containing small kernels. This fruit when boiled yields an oil, which becomes when quite cold a hard substance, of which candles are made in Ceylon.

The cultivation of the plant is by no means difficult: it requires a hot, damp atmosphere, a sandy soil, enriched with decayed vegetable earth, and a shady spot has to be chosen for the young plants. Given all these qualities of soil, and the necessary shade, nothing further is required, after the young plants are put in at equal distances, than weeding now and then, and the earth being stirred around their roots. No barking is commenced until the ninth year; the peeling of the bark begins generally in May, and lasts till October or November. The young twigs are first slit in a longitudinal direction, and then transversely; the bark is then stripped from the tree, and carried to the peeling shed, to be prepared for packing; the young shoots are also cut sometimes in lengths, and the bark peeled off them afterwards; then come the scraping, sorting, drying and rolling processes, which employ many men, women and children, after which the final packing in bags or bales, of from 80 to 90 lbs. each. Black pepper is usually mixed with

the bales, as it helps to preserve the cinnamon. In Ceylon, the peeling commences in May, after the rains, and lasts until November; the work being done by one particular caste of natives, *chulliahs*.

Sometimes two harvests are obtained each year from cinnamon groves; a large harvest in May and June, and a smaller one in November and December. In the Government plantations, however, never more than one harvest is allowed, lasting from May to November.

The quality of cinnamon depends very much on the fineness and thinness of the bark. When it is perfectly clean it is of a pale yellow colour, very pliable, and about the thickness of parchment. During the drying process, which is effected by spreading the bark on mats to dry in the sun, it curls up, and becomes of a deeper colour; the small pieces are put inside the larger quills, and the roll closes into the form in which it is seen in shops. The best "sticks" come from Ceylon; the best Indian variety from the Malabar coast; other inferior sorts being brought from Sumatra, Java, Cochin China, Cayenne, the Isle of France, and the Leeward Islands.

The tree being a very easy one to grow, provided a suitable soil can be found for it, it has been suggested that it should be introduced, and the cassia also, into British Burmah. Many suitable localities could there be found for it; and the industry would be one well suited to the native population, who might be able to make it a source of wealth to them, and the Government obtain, also, a permanent increase to their revenue.

GINGER.

The *Zingiber officinale*, or common ginger of commerce, belongs to the natural order of *Zingiberaceæ*, of the class Endogens. The plants which belong to this order are herbaceous, and furnished with creeping and

frequently jointed rhizomes. Most of the species are tropical plants, and the greater number of them are found in the East and West Indies, in Africa and America. The *Z. officinale*, the narrow-leaved or common ginger, seems to have been indigenous in the East Indies; for Acosta states that one Francisco de Mendoza first transplanted the ginger plant into New Spain from the East Indies, and it was naturalized in America very soon after its first discovery by the Spaniards. The common ginger has smooth lanceolate sub-sessile leaves, elevated oblong spikes, acute bracts and a 3-lobed lip. It flowers generally from August to October. The tuberous root of this plant is the ginger of commercial value. In India it is very extensively cultivated all over the peninsula. The soil which best suits it is a moist one, neither gravelly nor swampy. It is propagated both by cuttings of the roots and seeds of the plant; the natives commence its cultivation usually early in May, pursuing, according to Symonds, who gives, in his "Commercial Products," an account of its cultivation, the following process:—At the commencement of the monsoon, beds of 10 to 12 feet long, by 3 or 4 feet wide, are formed, and in these beds small holes are dug, at $\frac{3}{4}$ to 1 foot apart, which are filled with manure. The roots, hitherto carefully buried under sheds, are dug out, the good ones picked from those which are affected by the moisture, or any other concomitant of a half year's exclusion from the atmosphere; and the process of clipping them into suitable sizes for planting, performed by cutting the ginger into pieces of $1\frac{1}{2}$ to 2 inches long. These are then buried in the holes, which have been previously manured, and the whole of the beds are then covered with a good thick layer of green leaves, which, while they serve as manure, also contribute to keep the beds from unnecessary dampness, which might otherwise be occasioned by the

heavy falls of rain during the months of June and July. In the course of from three to five months, the rhizomes acquire an aromatic flavour, and then they are used to prepare preserved ginger, which is made by digging up the roots in the sap, the stalks being then about five or six inches long. These young roots are then scalded, washed in cold water, and peeled very carefully. This process extends usually over four days, the water during this time being changed very often. When the roots are considered quite clean, they are put into jars, and entirely covered with a weak syrup, made of sugar. This syrup is changed in a few days for a stronger concoction, and the process repeated three times, the syrup being each time made of increased strength. Finally, the ginger is tied down, and is ready for exportation. Essence of ginger is made by macerating ginger in alcohol. When the tubers of ginger have been planted from 12 to 18 months, they are ready to yield the ginger of commerce, *i.e.*, white ginger and black ginger, the difference in the kinds depending entirely on the different methods of preparation. For white ginger, the roots are scraped quite clean, and very carefully dried without scalding. For black ginger, they are scalded first in boiling water, and then dried in the sun. The white ginger is far superior to the black, and invariably fetches a better price in the market.

The ginger exported from Calicut is the produce of the Shernaad district, where the soil is very rich, and the ginger plant attains to great perfection. The Malabar ginger is considered of better quality than that exported from other parts of India. *Z. Zerumbet*, or broad-leaved ginger, is also a native of the East Indies, and is much used in medicine for external applications only; the ordinary ginger, on the contrary, being used internally and externally in a variety of ways.

Dried ginger is usually imported in bags containing about a cwt. each. The chief characteristics of goodness to be sought for in ginger are its soundness, freedom from worm holes, heaviness and firmness; small bits, which are friable, soft, tight, and fibrous, are worthless. Formerly, ginger was burdened with high duties; but in 1859 these were entirely repealed, and the consumption of ginger in the United Kingdom has since that date increased very much.

PEPPER.

Botanists consider that there are over 80 species of this genus, of which the principal is the *Piper nigrum*, which yields both the black and white peppers of commerce.

This plant is indigenous in India, Java, Sumatra, and Borneo. Malabar being in India the chief pepper district, the produce of the pepper-bushes on the Malabar coast are in better demand than the exports from any other district.

The *Piper nigrum* is a perennial plant, of a shrubby climbing nature, needing support like a vine; it climbs from twenty to thirty feet, if allowed to do so, but when cultivated for the sake of its fruit, it is usually cut to twelve feet; the branches then drop downwards, and bear spikes of green flowers, which are followed in due course by the pungent berries, which hang in bunches; the fruit growing distinct, like currants, on tiny stalks. When ripe these globose berries are red; after drying, black and shrivelled. The leaves are not very unlike ivy leaves in shape, only rather larger, and of a paler green colour. The pepper vine is by no means hard to cultivate, especially in those districts to which it is indigenous. It is very prolific, but does not bear until the third or fourth year, continuing in full bearing until

the eighth, when it gradually declines, its crops lessening for the next two years. When in full vigour, as much as 7 lbs. of pepper have been obtained from a single tree.

Pepper plants are propagated by cuttings or suckers, which are put down at the beginning of the rains in June. The plants are usually placed at the base of some rough-barked tree, such as the Jack (*Artocarpus*), mango tree, areca catechu, cashewnut, and others of a like nature. While they are growing, all superfluous shoots are cut off, and the plants are pruned and thinned when necessary. The berries are gathered usually before they are quite ripe, and dried on mats in the sun, which shrivels them up, and changes their colour from red to a deep brownish black. The berries are separated from the stalks by hand-rubbing. Both black and white peppers come from the same plant, the white being merely the black steeped in water and thus freed from its outside skin; by this means it loses much of its pungency, but is more easily reduced to powder, and becomes of a greyish-white colour instead of black. Two crops are produced in a year from the same plants; the first and most valuable crop in September and October, and the lesser crops in March and April.

Malabar pepper ranks the highest in point of quality, and is acknowledged to be the best, though so many countries compete with its produce in the market. Pepper has been an article of Indian export for very many centuries; and it is mentioned by many early writers, one in particular (Persius) calling it *Sacrum*, which shows how very highly it must have been thought of in his time.

As a seasoner of food, pepper will always be much sought after, for it possesses not only flavouring properties, but it also has a beneficial effect, if taken in

moderation, on the digestive organs. The root of the pepper plant has also its uses, being reckoned a good tonic, a stimulant, and a cordial. The berries, too, are given medicinally.

The *Piper nigrum* is not the only variety of this species which is used as food; for the *Piper betel*, also a native of India, being found in Travancore and other parts, is extensively used by the natives, who chew its leaves mixed with chunam and areca nut: the Chinese also using the leaves in the same way, the *Piper betel* being indigenous in China also.

Piper longum is also a native of the East Indies, being found in Malabar and Bengal; it is not nearly so strong as the fruit of *Piper nigrum*, is gathered while green, because then it has the most heating properties, and is imported in entire spikes, which are about 1½in. long. The root of this plant is very highly thought of in India by the natives as a medicine, being given in cases of palsy, apoplexy, tetanus and other diseases.

The largest exportations are of *Piper nigrum*, [illegible] black pepper obtained from it being in great [illegible]. Formerly, the duties on pepper were [illegible] and out of all proportion to the price of [illegible] to 1823, the duty was as high as 2s. 6d. per [illegible] it was lowered to 1s. per lb.; [illegible] the price of pepper per lb. was from [illegible] very disproportionate, and represented from 2[illegible] per cent. In 1837, a further reduction [illegible] took place; while in 1866, the duty was [illegible] when the increase in the consumption [illegible] markedly increased, and has continued [illegible] that date. Mr. McCulloch states that [illegible] pepper imported into the United Kingdom [illegible] was £568,102, which, however, was [illegible] value for the two preceding years.

CHAPTER XXVII.

SUGAR.

THE sugar question has recently been fully ventilated, and not before it was really necessary, the result of the inquiries into the subject of the Foreign Bounty System plainly showing how much and how injuriously it is affecting our trade in that particular industry: our West Indian Colonies more especially suffering at this present time from the rapid increase in the continental beetroot sugar trade. It will doubtless have been observed that the produce of our East Indian possessions from the growth of the cane have hardly been mentioned, except under the head of supplies from British tropical countries.

In the West Indies, as Mr. Richie pointed out, the growth of cane sugar has only increased in 50 years by 30,000 tons, while beetroot sugar on the continent has moved on in the same period 1,113,000 tons. The supplies from our British producing colonies have materially decreased since the introduction of the bounty system; while the continental supplies have, on the contrary, considerably increased. The effect, moreover, on our sugar refining industry has been to cripple and almost deaden it; so much so, that the once numerous sugar refiners could now be counted on the fingers of one hand. Manufacturers have been ruined, and numbers of workmen thrown

out of employ simply because they have found it impossible to compete in the market with the manufacturers of France and Holland. While the continental exports of loaf sugar stand at 400,000 tons, ours are now literally at a *standstill*. And unless this depression of our sugar trade is checked by some prompt, wise, and salutary measures, we are likely to suffer even more severely.

It is not, however, my intention to enlarge on this vexed subject, but simply to give some account of the branch of the industry as carried on in our East Indian possessions.

We are indebted to India for the original discovery of this valuable vegetable substance. Hamilton says that the sugar-cane was introduced into Arabia from India, and from Arabia into Europe and Africa. The derivation of the name *sugar* agrees with the supposition that the Indian natives first became aware of its uses, for the Sanscrit word for sugar is *sarkarâ*, whence the Persian *shakar* and *shakkar*, the Arabic *sokkar*, the Latin *saccharum*, and so on.

It is impossible to mention all the early writers who have directly or indirectly mentioned the substance, though most of their ideas on the subject were incorrect, and few had any notion even of the roughest and most primitive method of extracting it from the cane. Herodotus alludes to "honey made by hands of men;" Strabo states that the "reeds in India yield honey without bees;" Dioscorides writes of *saccharum*, indeed he is said to be the very first writer who made use of that word as denoting the juice of the cane; and he describes the article "as a sort of concreted honey, found upon canes in India and Arabia Felix;" Pliny, too, mentions the honey collected from canes as a sort of gum; these early writers evidently thought the substance grew on the cane, instead of being extracted by

pressure out of it. Theophrastus also writes of different kinds of honey obtained from flowers, from the air—honey dew—and from canes or reeds; Dionysius wrote that "the Indians drank the juice of the cane," and Arrian "of a nation who drank honey of the reed called sugar." Seneca, Galen, Erastosthenes, Varro, and many others all mention sugar, or "honey," as they mostly call it. Albertus Agnensis, in the year 1108, says, that sweet-honeyed reeds, called "Zucra," were found in the meadows about Tripoli; so that the growth of the cane was then evidently spreading in other countries.

The sugar-cane has been cultivated in Bengal from the remotest ages. From Benares to Rungpore, and from the Assam borders to Cuttack, there is scarcely a district in Bengal or its dependent provinces, in which the sugar-cane does not flourish, the climate and soil of India seeming especially to suit its growth, the only wonder being that its productiveness is not more severely tested, and that it is not more in demand. If its manufacture was as thoroughly understood and carried out in the East Indies as in the West Indies, it would and must become a much more telling article of produce than it is at present. The growth for home consumption is vast; and with encouragement and more capital expended on proper machinery, its demand in Europe would rapidly increase. The Indian ryot, however, is unfortunately far behind the times in the matter of new inventions: when it is merely a question of hard labour, he gets on well enough, for he is persevering and industrious, he works early and late; and the price for labour being very low, he can obtain extra hands without much expense: but when it comes to setting up expensive machinery then he is nowhere. One thing is, that Indian ryots are usually the poorest of the poor, and have no money to spend in even necessary investments, living generally a hand-to-

mouth sort of life, of which we here in England can form no idea. But, apart from this, they have no inclination; they would almost rather suffer than move out of the humdrum routine of daily toil. They dislike any departure from the ancient customs of their predecessors; and so they are distanced in the race, particularly in the sugar race—by other countries which keep their eyes open to new inventions and profit by them. Something more than mere bodily labour is required in the proper manufacture of sugar from the cane. An acquaintance with chemical science, and the necessary apparatus and machinery, must be forthcoming if the produce of the sugar-cane is to be really worth anything. The ryot's inveterate prejudices step in here, unfortunately for him; and he refuses to profit in any way by the discoveries of scientific men, preferring his simple and rude methods of refining to the more skilful appliances by which others benefit. If his eyes could be opened to these hurtful prejudices, and he would provide himself with the proper and necessary machinery, there is no doubt that East Indian sugar of a quality quite equal to the West Indian could be brought into the European market, and at a low price.

The sugar cane (*Saccharum officinarum*) is a jointed stalk, and at each joint produces a leaf; some specimens have as many as eighty joints in the entire length of the cane: there is a considerable variation in the growth of canes, depending upon the nature of the soil; for instance, in new and moist land it reaches to 18 or 20 feet, while in arid and stony ground it does not exceed 8 or 10 feet. Its propagation is effected from cuttings, seeds never vegetating. The top joints are generally used for this purpose, as they are not so full of the saccharine matter as the lower and thicker joints. A field is prepared for cane planting in this manner: the ground is marked out in rows, two, three,

or four feet apart; and holes are dug in these lines at intervals of two feet, the holes being from ten to twelve inches in depth. The hoeing a cane-field is very heavy work. Formerly this work was done entirely by hand, but ploughs are employed now in some parts. In India, great pains are taken with the ground prepared for planting; and the plants are tended, weeded, watered, and carefully freed from insects at all stages of their growth. Insects often commit great ravages on the sugar-cane, and are carefully watched for and destroyed; at times, though, they amount to a perfect blight. Insects are not the only enemies to the sugar-cane, for frequently the crops suffer much from the attacks of wild animals. Elephants are fond of browsing on the young shoots, and trample down even more than they eat. White ants, wild hogs, jackals, and monkeys have also to be guarded against; the first-named being the worst foe of all, and the most difficult to get rid of.

Every ten or fifteen days the newly-planted canes are watered, and constant hoeing and weeding has to be carried on, besides manuring, which generally takes place about two months after the planting. Drains have to be made in the rains to carry off the water. In September, the canes having been planted in May, the plants will be about four feet high, and in January the canes, then about the thickness of a good-sized walking stick, will be ripe and fit to cut. The leaves are stripped off the plants, and the tops cut off; they are then cut close to the stole, divided into convenient lengths, tied up in bundles, and carted away if the land is fairly level, or carried on the backs of mules if steep and precipitous to the mill, which consists of three iron cylinders, standing in a line with cach other, either perpendicularly or horizontally, placed in the form of a triangle, and adjusted so that the canes being passed twice between the cylinders have all their juices ex-

pressed. The juice, which is an opaque, slightly viscid fluid, of a dull grey olive, or olive-green colour, of a sweet taste, and of a specific gravity varying from 1·033 to 1·106, is collected in a cistern, and must at once be placed under the influence of heat to prevent its becoming acid, which it will do sometimes in even twenty minutes from the time it has passed through the mill. Lime water or powdered lime is added to the juice to cause the feculent matters contained in it to separate; these impurities come to the surface at a certain temperature of heat, and are then carefully skimmed off, the juice remaining goes through a rapid boiling, which, evaporating the watery particles, reduces it to such a state of consistency that it will granulate when cooled.

The amount of sugar obtained from a certain measure of cane juice varies with the season, the soil or the time of year, as also with the quality of the canes themselves. A general calculation, however, may be made, taking all adverse [illegible] consideration, that every [illegible] gallons of juice [illegible] six pounds of crystallized sugar, and [illegible] from about one hundred and [illegible]

The dried canes, after [illegible] tracted, are used for fuel.

After the sugar has [illegible] the purpose, it is [illegible] ping; but in the [illegible] drilled in their [illegible] and drain into the [illegible] stand. After the [illegible] up, headed down, and [illegible]

In some parts [illegible] standing on the [illegible] curious superstition [illegible] The ryots reserve a [illegible]

ceding year, to serve as plants for the next year. If any plants are left over, too many having been kept, the natives, on the eleventh of June, go to the cane-field, sacrifice to *Nagbele*—the tutelary deityo f the cane—kindle a fire, and carefully consume the superfluous canes.

They do this. from a fear that if the old canes remained longer in the ground, they might produce flowers and seeds, which event—if it happened—would betoken to those who beheld the flowers the very direst misfortune that could befall them.

There are four sorts of sugar usually met with in commerce : *i.e.*, brown, or muscovado sugar ; clayed sugar ; refined, or loaf sugar ; and sugar-candy ; the difference between the sorts depending entirely on the different ways in which they are prepared.

The method of preparing "brown or muscovado sugar" has already been shown. "Clayed sugar" goes through the same process up to a certain stage ; when the proper consistency is reached, it is poured into a large mould, with the pointed end downwards, the top of the sugar is covered with thin clay—hence the name —moistened, the molasses escape through an aperture in the point of the vessel, or mould, and the water in the wet clay soaks through the sugar, and washes out still more molasses, purifying the sugar by its percolation through it. Refined sugar is made from either brown or clayed, by a process of re-dissolving the sugar in water, and boiling it with certain purifying ingredients, it is then strained through similar moulds as those used for clayed sugar with clay spread on the top. Sometimes it undergoes this mode of treatment twice; but new and better methods of treatment are frequently being discovered; each fresh year seeing the invention of some more perfecting process. Sugar-candy is sugar which, after going through a refining

process, is [illegible]
crystallize [illegible]

We gather [illegible]
sugar trade, [illegible]
Indian sugar [illegible]
the Mauritius [illegible]
Indian imports [illegible]
year 1825, [illegible]
were returned [illegible]

In 1825.	[illegible]
In 1835.	[illegible]
In 1845.	[illegible]
In 1855.	[illegible]
In 1856.	[illegible]
In 1857.	[illegible]

But from [illegible]
ually fell off. [illegible]
Within the last [illegible]
siderable fl[illegible]
when the expo[illegible]
seen in the [illegible]

Year	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

In the year 18[illegible]
raised to a high [illegible]
Cuba cane crop [illegible]
therefore found a [illegible]
and was not slow [illegible]
the activity of that year [illegible]

in the ensuing, owing to a partial failure of the cane crops in the North-Western Provinces, which the export trade of the current year has not yet recovered.

The refined sugar, known in the trade as "crushed lumps," has very rapidly superseded the finer descriptions of East Indian sugar. Much of the sugar now forwarded from India to the United Kingdom is of very inferior quality, only fit for the brewer's use.

Loaf, or lump sugar, is but little used in India, sugar-candy being about the only species of refined sugar made use of; which seems strange when we consider how well the sugar-cane flourishes in every part of the country. The home consumption of the rougher sugar is very considerable, the estimated annual produce being close on a million tons.

These three sorts of canes are the most cultivated:—The *Kajooli*, or purple-coloured cane; the *Pooree*, or light-coloured cane; and the *Kulloor*, or white cane. The first-named grows on dry land in Bengal, the second requires a richer soil, and the third grows best in moist swampy ground, which does not suit the other kinds. This is the most generally cultivated.

Dr. Buchanan mentions four kinds common to Mysore—the *Restali;* the *Putta putti*, which yields the most jaggery; the *Cuttaycabo;* and the *Maracabo.*

With the extreme facilities for cane-growing and sugar manufacture in India, it is wonderful to find her export trade in the article comparatively of such small account; but it's the old, old story of poverty, want of capital, and want of energy on the part of the ryots, which deaden the exportations. With inferior machinery and inadequate appliances, the article exported can hardly be of a superior description, or calculated to bear competition with that supplied from other places. There is but little hope of improvement, either in the quality or quantity of the exports, so long as India con-

tinues in the impoverished state under which it is at present her misfortune to suffer, unless British capitalists step in, with the revival of trade at home. and impart fresh life and vigorous energy to this important industry.

The high rates of duty formerly charged on East Indian sugar did much to cripple the trade in its earlier days, and prevent speculation in it. For example, in 1830, while the duty on West Indian sugar was reduced to 24s. per cwt., East Indian was still at 32s.; and not till six years later was the duty charged the same on both East and West Indian products. In 1845, the duty on British Colonial sugars was reduced to 14s. per cwt.; and from 1848 to 1854 the reductions in duty went on progressively, the trade increasing in proportion; for while, in 1844, the consumption of sugar amounted to 206,472 tons, in 1847 it had increased to 290,282 tons; and in 1854, when the duties were equalized, to 401,437 tons raw and 15,182 tons refined; this quantity having, in 1868, been still further increased to over 600,000 tons, exclusive of molasses.

In the interests of India, it is to be hoped that she will, in future years, figure more largely in the sugar trade returns than she does at present. Possibly for her sugar industry, as for all her other sources of natural wealth, there may be yet "a good time coming."

CHAPTER XXVIII.

TEA.

THE tea-plant, the *Thea* of botanists, was discovered in 1823 to be indigenous in Assam by Major Bruce. At first it was not considered to be the genuine tea-plant; but Mr. Griffith, after a thorough examination, pronounced the *Thea Assamensis* (the Assam tea) to partake of the natures of both *T. bohea* and *T. viridis*. He also compared it with two species of *Camellia* from the Khosnia Hills, and decided that there is not the difference usually supposed to exist between *Thea* and *Camellia*, that the dehiscence is of the same nature in both, that is loculicidal, and that the only existing difference is of specific value, consisting in the fruits of the *Thea* being three-lobed, of the *Camellia* triangular. The Calcutta Tea Company in 1835, wrote: "We are now able to state with certainty that not only is it (the Assam) a genuine tea, but that no doubt can be entertained of its being the identical tea of China, which is the exclusive source of all the varieties and shades of the tea of commerce." In size both of plant and leaves, the Assam tea approaches to the green tea of China, as also in texture of the young shoots and leaves, and is found in much the same latitudes.

The first attempt to introduce its cultivation in India may be said to have commenced about 1830, a few years after Mr. Bruce's discovery of its existence. In 1839

that gentleman was appointed superintendent over the tea plantations in Assam; the similarity of the climate of that country with that of China, it being more temperate than that of Bengal, was noted by Government, and led to the determination to form tea plantations in those districts where the tea plant had been found growing in a natural state. From Assam, the movement extended into Cachar and Silhet, and after a time into the hill districts of the North Western Provinces of India and the Punjâb.

Seeds were imported also from China; and Chinese labourers, skilled in the cultivation of the plant, brought over to instruct the natives in its growth and proper treatment; these men were sent to the different nurseries and plantations already formed in Kumaon, Gurwhal, and in the Dehra Doon. The Chinese coolies asserted that the tea plant of Kumaon was precisely the same as that indigenous to China. China seed (imported) was tried in Coorg, Mysore, and the Neilgherries, but with very little success. In Kumaon and Gurwhal, however, the nurseries prospered; as also in the valley of Degra, in Guddowlie near Paorie, in Eastern Gurwhal, Kosilla, Almorah, Bheem-tal, and Hazarah, in the Scinde Saugur Doab of the Punjâb.

In 1843 the first crop of tea was obtained from the Dehra Doon; but previous to this, in 1838, the first twelve chests of tea from Assam were received in England, the samples being favourably reported on, and pronounced full flavoured, strong, and quite equal, if not superior, to the Chinese teas then imported for sale. Mercantile associations began to be formed in Assam in the following year, 1839, when the prices fetched by Assam tea were from 16s. to 34s. per lb.; in 1846 they had fallen to 6s. 10d. to 10s. 10d. per lb., and a few years afterwards the Government disposed of their establishments and relinquished this pursuit to

ordinary commercial enterprise. In 1851 the crop of the Assam Tea Company was estimated to have produced 280,000 lbs.

At this time Dr. Jameson had charge of the Government tea plantations in Kumaon; and so encouraging was the result of his efforts that he introduced the plant into the Punjâb, choosing the Kangra Valley as the spot for his further operations, and establishing two nurseries at the elevations of 2,900 and 3,300 feet above the sea level. These plantations succeeded beyond all expectation; and we learn from his report that in 1869 there were no less than nineteen plantations in the Kangra Valley, containing an area of 2,635 acres, and producing in the season 1868, 241,332 lbs. of tea, the average produce per acre being 91·6 lbs, and the average price realized by sale, 1-1-3 rupees (2s. 6d.) per pound; while in the same years, 1867-8, the Kumaon plantations yielded, of various sorts of tea, black and green, 21,588 lbs. Kumaon possesses a climate different to any other part of British India, that is, in its soil and general condition and it can be made to yield the products India requires for home consumption and exports better than other parts. In tea it is especially productive; and now there are plantations which yield 300,000 lbs. out of the thirty millions produced in India; a very rapid increase from the amount of pounds yielded ten years previously. In the winter months, though, the cold and severe frosts prevent the yield averaging so much per acre as in Assam; but the tea itself is of a better class and finer quality, and commands a good price, more especially in private sales, it being able to be used as a "whole" and "unmixed" tea, which is not usually the case with *T. Assamensis*, which the home dealers use chiefly as a flavouring for other teas. The demand for Kumaon is, therefore, not so great at home as the planters in that

part desire, and they send the greater portion of their green teas to Central Asia by the Cabuli traders, who make annual visits to Kumaon, and often buy up nearly the whole produce of a plantation at once.

The tea-planting industry in the Neilgherry Hills is also increasing. Up to the end of 1869, no teas were exported from Madras; since then the exports have risen from 6,166 lbs. in 1870, to 104,041 lbs. in 1875, and are estimated for 1878 at 400,000 lbs. This increase, for a trade which has so recently been established, affords good promise for future growth.

At Darjeeling the tea plantations are very extensive. Lately a most destructive fire has caused immense loss. The fire is supposed to have been caused by a careless native setting light to some jungle adjoining the tea gardens on the Mim estate. Some 15,000 fine trees were burned; and the fire, spreading rapidly, passed on to the Tumsong and Lingea estates, which also suffered severely, losing not only several thousand good trees, but having huts, outbuildings, and stables burnt down as well. When we consider that the tea-plants do not bear their first crop until they are three years old, and that they cannot be considered in full bearing until their seventh year, some idea of the loss these estates have sustained will be gathered.

Tea plants are raised from seed which is used shortly after it ripens, as it is not a good keeping seed; it is dropped into holes four or five inches deep and three or four feet apart. Sometimes the seed is sown where the plants are intended when matured to remain, and sometimes sown in nurseries and planted out when fit to bear the operation; whatever method is adopted, the ground chosen is always carefully prepared by deep digging and manuring previous to the sowing taking place, and weakly shoots are carefully weeded out, only strong and healthy plants being allowed to remain.

The tea-plant *Thea viridis* (Linn.), is a polyandrous evergreen shrub, resembling the myrtle ; it grows from three to five feet, sometimes attaining to six ; its stem is bushy, with numerous branches, full of leaf. The leaves are alternate, large, elliptical, obtusely serrated, veined, and set on short channelled foot-stalks. The flowers are white, axillary, and rather fragrant, often two or three together on separate pedicles, the capsules three-celled and three-seeded. The leaves are of course the valuable part of the plant.

The usual allowance of seedlings to an acre is about 4,000, that is if they are planted about four or four and a-half feet apart: at least twice a year the soil is turned up with the *kodali* (hoe), grass and all weeds are removed and manure given, the tops are top-pruned and have all their buds and blossoms carefully picked off, no seeds are allowed to ripen. The new shoots, or "flashes," as they are called, come on four, sometimes five times between April and October, and when these young shoots are three or four inches long—the plants having arrived at an age to be plucked—the pickings take place. In the North West Provinces the plucking season begins late in March, or early in April, and continues almost to the end of October. This does not apply to Assam, because there the season begins earlier and ends later; but climate, soil and plant cultivated, all differ from the North Western Provinces of India.

Care has, of course, to be exercised in leaf-plucking; immature shoots must not be picked, and weakly bushes not too unmercifully thinned; neither must old shoots, with hard leaves, be indiscriminately gathered; and unless coolies are well looked after, they are apt to do this, especially if paid by the weight of leaves they pluck, for the old shoots weigh more than the young and tender ones. The morning pickings are brought into the factory in the middle of the day, weighed at

once, and spread out lightly in a cool place; the afternoon's work is brought in the evening, weighed, and spread out in the same manner. In the hot weather, about 3 lbs. 10 oz. are reckoned to equal one pound of dry tea; in the rainy season, 4 lbs. 14 oz. will be required to make up the same weight. The next day the leaves of the previous day's plucking are all brought out of the factory and spread thinly on some sort of matting or carpet in the sun; turned over once or twice to assist the withering process, which is a very necessary and essential one, for by it the tea acquires a fuller flavour, and, when it is ready to be rolled, there is less danger of breakage. It is no easy matter, however, to ascertain how much withering the tea may undergo without becoming so dry as to be brittle and crumble under the manipulating processes it has to go through afterwards. When the "withering" is finished, then follows the "firing." The tea is placed in metal pans, set in a brickwork furnace, heated to a temperature of 240° or 250°; the leaves are turned incessantly during the time they are in the pans, which does not exceed ten minutes, to prevent their burning, which would spoil the flavour; they are then removed by hand or shovel, or brushed out, thrown on tables, and rolled and sifted while hot. This process is repeated, and then the leaf is placed in the sun again in shallow trays, prior to being put into sieves over slow charcoal fires. The next operation, "rolling," is both slow and tiresome work; the men employed take up as many leaves as they can hold in their hands easily, and roll them repeatedly backwards and forwards on wooden tables. If a man manages to roll from 25 to 30 lbs. of withered leaf in a day, he has done a good day's work, though that amount only represents some 7 or 7½ lbs. of dry tea. The "rolling" is generally gone over three times, and the leaf is then ready for "fermentation." This

merely consists in shaking the tea well up and throwing it loosely into heaps, which are covered over with carpets or mats, quite closely. The time in which the leaf remains in this state depends on two things—the quality of the leaf itself, and the state of the atmosphere. If warm and dry, and the article of a superior kind, then it is over in from four to five hours; if dull and damp, and the leaf inferior, then it will probably take from six to eight hours, or even more. A final drying is then given, and general sorting, sifting, and picking over, previous to packing in chests, ready for exportation.

In making black teas the foot-stalks are often collected with the leaves, unless for the very finest sorts such as Pekoe, which are made from leaf-buds not expanded. Green teas are made from the leaves alone. The natives do not, as a rule, use black tea, preferring green, even if it is not really genuine, but merely dashed with colour to suit their tastes.

Adulteration in tea is not nearly so much practised in India as in China. In the latter country they openly adulterate and doctor up their teas for the English and other markets. A Chinaman once actually showed an English gentleman, curious as to the manufacture of green tea, the manner in which from a black tea worth about 5d. per lb. he concocted a green tea worth 1s. 3d. per lb. They (the Chinese) use Prussian blue and gypsum largely in colouring their teas, also gallic acid, tincture of iron, and sulphuric acid, to give crispness to the tea, and produce a higher colour when subjected to boiling water in preparation of the beverage for use; they hardly look on such acts as wrong, for they argue, "We prefer our tea pure, and for our own use do not introduce any colouring matter; but find that other nations prefer a higher colour and give a better price for tea which has undergone a certain amount of

manipulation." The Chinese do not stand alone in such malpractices; for here in England, notwithstanding the heavy penalties on adulteration of tea which would be incurred on conviction of the offence, many very many leaves are substituted for, or mixed with, the genuine leaf: beech, elm, horse-chestnut, plane, willow, poplar, hawthorn, sloe and ash leaves, have all been detected in different analyses on suspected teas.

These different leaves are dried, broken up into minute fragments, mixed with gum, or *Terra japonica*, reduced to powder, coloured with various dyes –usually rose pink—and then mixed with ordinary teas, or else with used tea, which has been re-dried, and is offered again for sale.

The tea plant is a hardy one, and under favourable circumstances its cultivation is a very profitable proceeding. It wants, of course, considerable capital to commence a tea garden; and unless the would-be planter can afford to lay out at the outset at least £2,000, and wait some years before he sees any return for such outlay, it is not worth while his commencing the undertaking. A tea estate does not begin to turn in any profit on the expenditure for seven or eight years, sometimes not so soon as that, as the cost of working the estate is considerable; but if really in a flourishing condition, and presupposing a good market has been found for the sale of the produce, then from 10 to possibly 20 per cent. may be looked for. If we look at the quotations of the various tea companies in the different Indian papers, we shall not find many that return as much as 20 per cent., a few over that rate perhaps, but very many below even 10 per cent.

The Assam and Cachar teas, in particular, continue to command good prices in the home market, the export of Assam tea to Great Britain having doubled in the last five years and being still on the increase; but they

are old and well established teas, and by their very popularity lessen the chances of sale for new and less tried samples from fresh and comparatively little known estates. The Indian home consumption is, however, yearly on the increase, the native population coming forward as purchasers of tea to a considerable extent; their taste for it has of late years been shown to be rapidly growing. The numerous plantations do a great deal of good to the agricultural population of India by giving employment to thousands of men, women, and children, and thus increasing their general prosperity; not that the Indian labourer can ever, at any time, be cited as a prosperous being, but, comparatively speaking, the tea-industry enriches him, not only by supplying him with work, but also in bringing extra hands into the different districts, who have to be found in food by the villagers round.

In selecting sites for tea gardens the chief considerations are soil and climate. A rich loamy soil, under forest if possible, is considered the best for a tea plantation, with a tolerably moist climate; one that has a good long rainy season of some months, during which the temperature is from 75 deg. to 80 deg; food and cheap labour, and above all a good variety of the plant. What is called in India the China sort of tea is not held in such estimation as the Assam tea. It is not so productive, nor of so good a quality. Under a system of high farming it is thought that an acre of tea bushes might be made to produce from 200 to 250 lbs. of tea—at least, so says Major Paske in his report on the Kangra district; but such results can only be expected when all the conditions found are really favourable to tea plant cultivation.

The annexed table will show the great increase which has taken place in the Indian tea industry within the last five years:—

Years.	Lbs.	Rupees.
1873-74	19,324,235	1,74,29,256
1874-75	21,137,087	1,93,74,292
1875-76	24,361,599	2,16,64,168
1876-77	27,784,124	2,60,74,251
1877-78	33,459,075	3,04,45,713

In England Indian tea holds its own very well against China. In 1872, the imports of Indian tea were to those of China tea as 1 to 9·7, in 1874 as 1 to 7·5, in 1876 as 1 to 5·6, and in 1878 they were as 1 to 4·7. The average declared value of Chinese tea on import into England was:—

In 1877 .... 1s. 3d. per lb.
In 1878 .... 1s. 2½d. per lb.

While that of Indian tea was:—

In 1877 .... 1s. 8¾d. per lb.
In 1878 .... 1s. 6¾d. per lb.

This last is a very low figure comparatively for Indian tea, the lowest yet reached, and the same may be said for China tea.

The above figures are quoted from Mr. O'Conor's "Review of the Trade of British India."

It would seem from the latest returns received by the Government of India that the total area under tea in India in 1876-77 was 145,685 acres, and some 483,423 acres had been taken up for planting, but not yet planted. Large extensions in the area under tea were made in 1877-78 in the Assam and Bengal tea growing districts. The year 1879 was not a favourable year for tea-planters; and Messrs. Balmer, Lawrie and Co., in their tea circular, reviewing the past year, say, "that the year 1879 will long be marked and remembered as

one of the most extraordinary experienced by tea-planters. All districts had somewhat similar weather; a hot dry spring, and late commencement of the season; excessively wet June, July, and August; fairly favourable weather in September, a good October, a dry November, and an early close; the tea suffered seriously during the hot weather in the early part of the season, while the incessant rain that followed, being unaccompanied by a sufficiency of sunshine, produced leaf surcharged with water and wanting the essential constituents for making good strong tea; all the early shipments were classed as weak, and there was little change until September; a difficulty in withering during the dull cloudy days and cold nights may have increased the evil; but the main cause of the bad weak teas seems to have been the want of strong sap in the leaf. As regards quantity the outturn for the season will not nearly come up to the estimates; looking at shipments to the end of November, and taking into consideration that nearly all Darjeeling tea is down, while Assam and Cachar have probably less tea to send than they had last year, we think the quantity available for export will probably be well within 37,000,000 lbs.; possibly not more than 36,000,000 lbs. Notable features resulting from the unfavourable weather are the check given to transplants and young bushes, the bad crop of seed, and the prevalence of blight."

When the extra extent of area under tea taken up and planted last year in Bengal and Assam come into bearing, a great increase in the exportations may be looked for, but some years must elapse before this is the case

CHAPTER XXIX.

TOBACCO.

INDIA'S tobacco trade has within the last five years rapidly increased. The greatest attention is now paid to the growth and cultivation of the plant and its subsequent manufacture. It is thought that in a few years East Indian tobacco will favourably compete with American.

The soil and climate of India are admirably suited to the tobacco genus, that is when due consideration is given to the proper period of sowing, the degree of moisture, and the due preparation and manuring of the land. Regarding its manufacture into cigars and smoking mixtures, American curers and manufacturers are now usually found on tobacco farms, and American appliances and machinery are very generally used.

Tobacco is the common name of plants belonging to the monopetalous genus *Nicotiana.* There are more than forty species of this plant.

The *Nicotiana tabacum* (Linn.) is really a native of the West Indies and of Virginia. In the former place the Spaniards first became acquainted with it, and in the latter the English, Sir Walter Raleigh being the first to introduce it from thence into England in 1586. It is not supposed to have been brought into India until 1617, when the Brazilians made it known in that country. According to De Canolle this species is her-

baceous, pubescent, glutinous, with a branched erect stem; oblong-lanceolate, acuminate, sessile leaves, the lower ones decurrent, pedicilled, bracteate, terminal, racemose flowers, white, green, or purplish in colour; permanent 5-cleft calyx; corolla downy, funnel-shaped with inflated throat, segments of the spreading limb pointed; stamens 5, as long as the tube of the corolla; capsule 2-celled, 2-valved; seeds very numerous, minute.

Until the last few years the tobacco trade in India was of small extent, but now many hundred acres are annually under tobacco cultivation, and each year the area so cropped increases. In the Salem and Trichinopoly districts in the northern parts of the Deccan, in Bengal, &c., tobacco farms may now be found.

Indian tobacco is chiefly grown from imported seed sown between the end of August and the middle of January. At this season of the year the Indian climate much resembles that of the Southern States of America during the tobacco season there. The plant is one of four months' cultivation. Seed sown late in December is ready to cut in April. The seeds, which are minute and very numerous, one pound of seed being sufficient to sow one *cawnie* of land, are sown in carefully prepared beds, the soil of which has been freshly dug, turned up and manured with equal parts wood-ashes and dung-heap rubbish. The ground to which the seedlings are to be transplanted is well ploughed and manured, narrow deep trenches are dug about a foot wide with ridges between them, on the top of which the seedlings are planted. They are ready for this removal when they have thrown out three or four leaves, the deep trenches are filled with water and the seedlings carefully inserted in the ridges between them, at distances from 16 to 18 inches apart. For the first few days they are daily watered, and after that every second day during the whole period of growth. About three weeks

after the plants have been transplanted they are thoroughly weeded by scraping between the plants with cocoanut shells. In another fortnight the weeds are again destroyed, this time by hoeing, and then any vacancies caused by plants dying are filled up with fresh plants from the young stock kept in reserve in the seed-beds for this purpose. At the end of three months a third weeding takes place, and the side shoots are broken off. When the leaves attain a certain size the lowest are pinched off, as this increases the size and vigour of those above; for the lower leaves often wither off before the upper ones have attained their full size. From eight to ten good sized leaves are left on the plants; the tops, too, are pinched off when the plants have grown to three feet, to prevent their running up and drawing away the nourishing sap from the leaves that remain; a certain number, however, are allowed to grow to their full size for the sake of seed.

Tobacco is subject to the attacks of various insects; caterpillars in particular commit dreadful ravages on the leaves, and a daily search has to be made for these pests.

The leaves as the plant ripens—about the end of the fourth month—get speckled and change colour, becoming a pale green, inclined to a yellowish tinge. They have also a brittle feel to the touch, and break between the fingers if roughly handled. They are then fit to be gathered, the size at this time of leaves on well-grown plants should be from 24 to 28 inches in length, and 4 to 6 in breadth; sometimes they are even larger. The plants are then cut down, but not until the dew is off the ground, close to the roots, leaving them still in the soil, they are left to dry and then moved under shelter before the evening dew falls. Moisture at this period would ruin the crops. The next day they are spread out on the ground on a pile of straw four or five inches deep. Here they are arranged in heaps, covered

over with palm-leaves, and pressed with heavy stones for five or six days. Then the pressure is removed and the stems are hung up to dry. When ready they are taken down, and again undergo the pressing and stacking process, this time in a room. The stack is turned every three or four days to prevent their heating too much; and this part of the treatment requires the greatest care, attention, and experience; for if they heat too much or do not heat enough, the result in either case is to injure the quality of the tobacco made from them. After this second heating the leaves are stripped off the stems, and tied up in bundles from fifty to seventy in each bundle. These bundles are stacked, covered, and pressed, being rearranged every three days for two or three weeks. After this they are considered fit for packing, and are ranged in layers in casks, the direction of the leaf points being reversed in each layer. When the cask is about a quarter full the tobacco is heavily pressed down by a powerful lever-press, which reduces the bulk from about 12 inches to 3, the pressure being kept on for some hours. By degrees the cask is quite filled, pressure being applied at intervals until the leaves are in one dense mass. It is reckoned that a 48-inch in length and 32-inch in diameter hogshead so packed will hold one thousand lbs.

The stalks left in the ground when the crop was cut throw up fresh shoots, which, being carefully watered and weeded, yield a second crop of leaves; but the tobacco made from them is greatly inferior to the first cutting, both in quantity and quality, being worth very little in the market.

Mr. Buck, in his "Report on Agriculture and Commerce for 1877-8," gives an interesting account of the tobacco farm at Ghazipur, from which the following extracts are taken:—"The operations conducted during the year by Messrs. Begg, Sutherland, who have now the

full control over these farms, have been important. At the beginning of the year 1877 I had obtained the consent of His Honour the Lieutenant-Governor of Bengal for the above firm, whom the North-West Government had established at Ghazipur, to treat with the Bengal Government for the occupation of the Pusa Stud estate; and arrangements were eventually concluded by which they entered into possession of Pusa a few months later. The position of affairs at the beginning of the year under report was the following:—In 1876-77 a crop had been raised from 52½ acres at Ghazipur; a severe hailstorm reduced the value of the crops, according to the firm's estimate, by fully one-third. The out-turn was nearly 59,000 lbs., exclusive of second cuttings retained by cultivators, but was not sent to England on account of its being so much broken by hail." The enterprise ran a great risk of failure from the illness of Mr. Williamson, the Virginian curer, who was obliged to be first sent to the Himalayas, then a sea trip to Java, that he might make enquiries respecting the cultivation of tobacco successfully carried on there, and recruit his health at the same time. During his absence the management of affairs was carried on by a European apprentice, who was placed on the farm at Government expense. "The ensuing drought, which was extreme at Ghazipur, prevented the growth of anything like a good crop at that farm; but the firm had, in anticipation of obtaining Pusa, secured a second professional curer and manufacturer from America (Mr. Cabaniss), who arrived in time to raise an excellent crop on 200 acres at Pusa—a result which justified my conclusions previously placed before Government as to the greater suitability of Upper Bengal climate for tobacco. The Pusa crops on 200 acres realized an outturn of more than 150,000 lbs., of which 15,000 lbs. have been sent to England, and valued at prices varying from 2½d. to 5½d.;

but the brokers say that it would have fetched more if it had been kept longer in this country to mature. Of the remainder a large quantity will be manufactured, and a portion sent to England as cured leaf. The two estates have now been placed by the firm of Messrs. Begg, Sutherland and Co. in the immediate charge of a member of the firm, who has taken up his residence at Pusa, visiting Ghazipur when his presence is required there. There are two professional American curers, one for each estate, who will now be relieved of all those worries of management which went some way to endanger Mr. Williamson's life, and a fifth (English) assistant has been trained in Germany in the cigar-making trade, and will shortly join. Meanwhile Mr. Williamson, while on leave in America, has been commissioned by the firm to import the best machinery of all kinds for tobacco and cigar-making."

The above statement proves not only the progress which the enterprise is making, but also the vigour with which Messrs. Begg & Sutherland are at work, and how fully they have justified the confidence which Government placed in them. When at the outset advice was given to employ Government agency alone, the issue was decided in favour of utilizing commercial enterprise as most likely to succeed; and it is certain that Government alone could never have made such rapid strides as Messrs. Begg & Sutherland, who, while they have connections in the trade in England and America, have not to ask the leave of half a dozen authorities when they want a new curer. The results of the operations hitherto undertaken are still uncertain. The firm are sanguine; "and I (Mr. Buck writes) am sanguine as to ultimate success; but time is still wanted. A crop sown in July, 1877, is cut in January, cured in March, sent home in the rains, kept in bond for a year (two are better), and opened for sale in 1879.

Of all the tobacco sent home only the small parcels of 1876 (which were the produce of a crop injured by hail and grown in the dry season) have been tested in the market. They realized a price three times as great as Indian leaf previously exported, and about two-thirds the price of American leaf of the same class."

The tobacco of 1877 has not yet been subjected to sale; but an offer was made by a wholesale English firm for a very large quantity annually at a price which would have paid a sure profit.

"No official report has been received in this office on the samples sent to England through official channels; but I have understood that they have not been favourably judged. This report does not agree with the fact that good prices have been privately offered to the firm in England, or with the opinion of the American curers, who are as good judges as any professionals can be; and time must be asked for before any final verdict is given. Sales in the open market are the best, and if these can be effected on favourable terms no doubt will remain as to the results."

The above remarks refer to cured leaf; attention is also being given to manufacture, and as the speciality of Virginians is smoking tobacco and not cigars, first experiments have been made with smoking tobacco.

A smoking "mixture" offered to the public has succeeded, and is showing signs of finding favour. Manufactured tobacco must, however, be much more restricted to the local market than cured leaf; and although an individual firm will no doubt make more profits by local sales in India, yet competition with the world must probably take the form of export of cured leaf.

A comparison of tobacco with tea may give some idea of the possible position which the former may take as a product of India. An acre of tea produces in Eastern Bengal about 300 lbs. on the average; three or four

years elapse before it begins to yield, and full vigour only lasts for a few years without expensive manuring. Cost of cultivation and manufacture is given at various rates; but there is reason to believe that, including export, it is not less than 4 annas a pound. The average price, good leaf and bad, is said not to exceed 9 annas a pound. At these rates net profits on 100 acres would be 300×5 annas $\times 100 =$ rupees 9,375. An acre of tobacco produces about 800 lbs. on the average; cost of cultivation and curing can, including export, be kept probably to 2 annas, and, if manufacture is added, to 3 annas. The price of cured leaf ought to be, if it is to compete with American tobacco, 5d. a pound, or 4 annas, and of manufactured tobacco in India about 10 annas. The minimum net profits of 100 acres at these rates are 800×2 annas $\times 100 =$ rupees 10,000 for cured tobacco, and $800 \times 6 \times 100 =$ rupees 30,000 for manufactured. The above figures show that there is as good, if not better, margin for profit in tobacco than in tea. The market in which it competes is of larger extent; and it is almost proved that tobacco cured in India can be sold in London at a profit for a price at which it would not pay America to send it.

Dr. Shortt also considers that tobacco cultivation allows a fair margin for profit. He states that the expenses attendant on cultivation are—

	rs.	as.	p.
For ploughing the land	14	0	0
Watering, weeding, &c.	15	0	0
Land rent	5	0	0
Total	34	0	0

The above is for cultivation of one *cawnie* of land. The value of the produce of one *cawnie* is about 350 *thooks* of tobacco, a thook representing 3 lbs. 10 oz. This would be valued at 150 rupees, from which if the 34

rupees for cultivating expenses are deducted, and about 16 rupees extra allowed for general expenses, the cultivator would have a clear profit of 100 rupees on every *cawnie* he had under tobacco cultivation.

The most usual complaint against East Indian tobacco has been that it is so rank and strong, owing to the large amount of saltpetre in Indian soil. A certain quantity of saltpetre is absolutely necessary to the wellbeing of the tobacco plant; the Indian native grower, having the idea that saltpetre is good for tobacco, overdoes it; he finds it stimulates the growth of the plant, and gives it that acrid biting taste the Indian market likes. So he grows his crop on unnecessarily strong and rich land, rendered so by his heaping on it as manure all the refuse he can which contains what he considers the *sine quâ non*—saltpetre. If it was made to his interest to grow a milder sort of tobacco, by a market for such sorts being opened up, then he would grow on less rich soil, lighter and better calculated to produce a mild flavoured leaf, and the results would be a better class of article in the market and less complaints would be heard of the undue prevalence of saltpetre.

The quantity of tobacco exported in the last financial year from India amounted to 6,126 tons, in value [illegible] 12,63,222 rupees, a very considerable increase on the exports of former years.

The accounts of the Ghazipur and Pusa farms show that a move has been made in the right direction; another firm is about to try tobacco cultivation in Bengal, and as it is open to English enterprise, [illegible] will doubtless yearly be taken up with the crop.

The imports of tobacco in India have fallen from [illegible] lakhs in 1876 to less than [illegible] lakhs in 1878, [illegible] very decided proof that the home manufacture in India is on the increase. The great [illegible] tobacco, both cured and manufactured, [illegible]

want of seasoning; it is in the market too soon after it is cured; cigars as well as tobacco are not kept long enough to mature properly.

The progress, however, in this industry in the North West was last year most encouraging, and the operations at Pusa and Ghazipur very much extended, the area cultivated being 239 acres, and the outturn of cured leaf being estimated at 165,000 lbs. Before long Indian tobacco will without doubt be placed in competition with American, especially if the improvements which have of late taken place in its growth and manufacture are continued.

CHAPTER XXX.

WOOD INDUSTRY.

A VERY considerable trade is carried on in inlaid woods. Framjee Heerjeebhoy says that this work was brought into Bombay from Persia through Scinde; and Shiraz is the place from which it is supposed to have originally emanated. Three Mooltanees, Devidas and Vulleeram, brothers, and Petshotum Heeralal, were the first who settled in Scinde over a hundred years ago, and from them the art gradually spread to Bombay, Surat, and Baroda. This industry now gives employment to many hundreds; and Dr. Birdwood says there are at least fifty shops now carrying on this trade. It is now, however, merely imitative, new designs being rarely seen, but only the old Persian geometrical combinations, which have been carried on since the first introduction of inlaid-wood working.

Ivory (white), samber horn (green), sandal wood in its natural colour, ebony, sappan wood, and tin, are the materials used in the work. The tin is generally bought round and cut into triangular shapes by being passed through a notched roller called *rát*. The various materials are glued together with Ahmedabad glue in different geometrical patterns. The following are the names of some of the patterns:—*Mhotee Kut-kee-no-gool*, a design of rather large hexagons; *Gool*, round; *Chorus-gool*, matting or square pattern; *Tun*

Dhar-no-gool, the triangle; *Adhee Dhar-no-gool*, the rhombus. While the names applied to the different kinds of borders used are, *Baelmootana*, *Ekdani*, *Jeri*, *Jafran Marapeek*, *Lehero*, *Poro Hansio*, *Sankro Hansio*, &c., &c. Carving in sandalwood, ebony and blackwood is also largely carried on in Bombay, Ahmedabad, Surat, and Coompta in Canara, from whence the best sandalwood carving is brought.

A variety of articles are made out of the materials named, boxes of various sorts and sizes, book-slides, paper-weights, paper-cutters, card-cases, book-covers, inlaid table-tops, card-trays, paper-cases, portfolios, envelope-cases, book-stands, needle-cases, inkstands, desks, cabinets, cribbage and chess boards, necklaces and beads, besides other articles too numerous to mention, all of which find a ready sale in England and elsewhere.

In painted, stained, coloured and gilded woodwork a considerable trade is carried on, and in the far-famed lacquered work.

CHAPTER XXXI.

WOOL.

THE greater portion of the wool imported into the United Kingdom formerly came from Spain. The Spanish wool has retained its good name; but now our imports are so rapidly increasing, the product of other countries swells the quantity imported; and South Africa, Australia, British India, Gibraltar, Peru, have all entered the lists. Before 1800, our imports of wool did not exceed 3,000,000 lbs., but in that year they rose to 9,000,000 lbs.; in 1867 they had increased to 230,224,467 lbs.; and in 1875 to 306,947,099 lbs., of which 21,290,782 lbs. came from India.

The imports of Indian wool only began in 1833, and they then only amounted to 3,721 lbs.; in 1858 they had increased to 17,333,507 lbs.; in 1867 they were 15,234,620 lbs.; and for the last five years they have continued to increase, with the exception of the last year.

Year.	Lbs.	Rupees.
1873–74	20,333,372	93,83,257
1874–75	21,290,782	95,99,000
1875–76	23,767,692	1,07,42,002
1876–77	24,056,767	1,07,73,720
1877–78	23,075,323	94,26,448

The exports of raw wool fell off in quantity in the last named year, owing probably to a reduction in the London prices, supplies being in excess of the demand; but the 1878-79 returns will probably show that the trade is again looking up, and the price now quoted for "East Indian ord. yellow" is 9d. per lb. as against 7½d. per lb. in 1878. The recent improvement in the wool trade rests in great measure upon the American demand, which is great; in the last four months some 24,000,000 lbs. of domestic and low foreign wools were taken out of the English markets. The Australian wools continue to fetch the best prices, with the exception of Turkish mohair, East Indian standing, unfortunately, lowest in the list.

In the country itself sheep's wool is much used in the different textile manufactures, but the quantity of wool produced in India is comparatively small, the native looms being supplied with imported wools; and the wool exported by India is, a very considerable portion of it at least, of non-Indian origin. The *pashm*, or shawl-wool, is a downy substance, growing next to the skin and under the thick hair of those goats found in Thibet and in the elevated lands north of the Himalayas; it is cut once a year, and is of three colours—dark-grey, drab, and white. It is imported from Chinese Thibet, from whence also comes the celebrated Turfani wool. Before the year 1867 none of this valuable wool was allowed to pass through the Maharajah of Kashmir's territory, it being a monopoly of his; and even now, when the free importation of shawl-wool is allowed, the Punjâb weavers use the kermani wool, a fine sheep's wool, called *wahab shahi*, which, though very fine, is inferior to the Thibet goat's downy wool; it is for this reason the shawls made in British provinces are of less value than those made in Kashmir. The other wools imported from the North West frontier are the

dumba wool, which is shorn from the large-tailed sheep common in Peshawur, Cabul and those districts; the *kirmani* wool before mentioned; the wool produced in the Punjâb comes from the large flocks of sheep which are kept in the *Thull* and *Bar* tracts of the Punjâb, the elevated portions of the Doabs.

Camels' hair is brought from the waste tracts of Shahpar, Rohtak, Shang, and Gugaira districts; where camel feeding is largely carried on.

CONCLUSION.

In conclusion it may be as well to draw attention to some of the lesser Indian industries, as well as to those recently opened up: for example, the cultivation of the ground-nut or pea-nut, the *Arachis hypogœa;* though its uses as an oil-yielder have long been known to the natives, who employ the oil expressed from the seeds for lighting and pharmaceutical purposes, for lubricating machinery and in soap making, still it is not such a valued plant as it ought to be, considering the ease with which it can be grown in India, its great productiveness—as much as 700 or 800 lbs. being produced per acre in favourable localities—and its nutritious properties as a substance for food. Lately an analysis has proved how rich this nut is in flesh-forming constituents, ranking before lentils or peas as a nourishing article of diet, and containing more fat and more phosphoric acid than either. It is also an excellent food for cattle, either given them in its leafy state, when it resembles clover, or in the form of oil-cake, prepared from the refuse after the finer parts have been extracted. It might also form an article for exportation in greater quantities: a large trade in these nuts being carried on in France chiefly with the western coast of Africa, from whence is shipped about 92½ per cent. of her imports. In France it is in great

demand, because of the oil it yields, the skill of the French chemists enabling them to imitate the pure Florence and Lucca oils with it, and so cleverly that even experienced judges have failed to detect the difference. India even now exports a very small quantity of Arachis into France, but only about one per cent. of the imports. She might well take a leading part in the trade, if more attention was paid to the growth and cultivation of this useful agricultural product.

Then in the matter of arrowroot much remains to be desired. The *Curcuma angustifolia* (Roxburgh), or Indian arrowroot, grows to perfection in many parts of India, in Nagpore, Travancore, &c. The *Moranta arundicinea*, the species indigenous to South America and introduced from thence into the West Indies, is also grown in Bengal.

East Indian arrowroot has, however, no market value in England, owing to the careless manner in which it is obtained, and the way in which it is mixed with other and inferior substances. This evil could and would, with greater care on the part of the manufacturers, be remedied. As matters are now, the ryots cannot procure seed tubers, and they do not know how to manufacture the article when they have raised it. This knowledge they might acquire, and with encouragement arrowroot cultivation might in time rank amongst the profitable industries of India.

I have said nothing of the Cawnpore leather trade, but leather is the staple manufacture of that city, where an extensive business is carried on in the manufacture of saddlery for the use of Government, in boots, shoes, and various other leathern articles; neither have I mentioned the trade in marabon feathers in Calcutta, they are the under-tail coverts of the adjutant or gigantic stork (*Leptoptilos argala*) and the smaller adjutant (*L. javanica*), and

meet with a ready sale in the country itself and in foreign countries also.

The trade in attar of roses is one which employs a great number of people. The roses of Ghazeepore came, it is said, originally from Bussorah. They were first of all transplanted from Persia, and brought to the now ruined city Kanauj on the Ganges, from thence they were moved to Ghazeepore, about a century ago. Since that time the rose gardens have been rapidly extended, the celebrity of the perfumes prepared from the Ghazeepore roses spread throughout India, and gradually reached other countries, and year after year traders came from long distances and set up temporary distilleries in order to keep up their stock of this rare perfume.

At Ghazeepore the roses are planted in large fields, the plants being raised from cuttings—not by grafting—which are planted out from the nurseries in which they are grown when they are a year old. They are planted in the fields about three feet apart, and have to be kept perfectly clean by frequent weedings, the soil also being stirred and loosened around their roots. The flowering season is in February and March, and the average yield of flowers per beegah is from 30,000 to 60,000. These are bought by the distillers at prices varying from 100 to 125 rupees per lakh of flowers.

In Ghazeepore there are about 200 acres of ground under rose cultivation, the rent paid averaging about 4 rupees per beegah.

Gootabee panee, as the natives call rose water, is very highly valued in India. That which has been skimmed is inferior to that which retains the essential oil floating on its surface; for this oil contains the concentration of aroma so much esteemed. This attar or oil of roses is collected in phials, and is sold by weight at 100 rupees to 125 rupees per tolah.

The trade in isinglass, fishmaws, sharks' fins, glue,

jellies, and preserves, edible nuts and dried fruits, preserved meats and fishes, pickles and condiments, bees-wax and vegetable waxes, gold, silver, and other jewellery, stone and cement wares, tortoiseshell, mother-of-pearl, whalebone and bone, are all worthy of extended notice, though I can only name these several industries here. I hope, however, that I have shown—for such has been my object in writing this book—that the resources of India are as numerous as they are varied. With so much natural wealth in the country, mineral and animal as well as vegetable wealth, and so little of it really developed or made the most of, surely it will be the fault of the possessors of this valuable empire if its future is not a prosperous one, or if it sinks into the bankrupt and impoverished state alarmists are so fond of foretelling.

India's future prosperity rests in the hands of England. If we do our duty towards her, improve her methods of agriculture, give her a proper system of irrigation, replant her thinned forests, reclothe her [illegible] slopes, encourage and develope her numerous [illegible] and in fact exercise a fostering supervision [illegible] branches of her internal economy, [illegible] country decreasing year by year in [illegible] more and more poverty stricken, a [illegible] gained each year.

That deterioration of the [illegible] writers have made such [illegible] by judicious and salutary measures, [illegible] and thoroughly carried out, [illegible] cured. To attack the present system of [illegible] ture and to improve it, [illegible] farming, but by such plans as [illegible] the nature of the country, and [illegible] prejudices of the ryots, not driving [illegible] new, but gradually leading them [illegible]

example, will be to cut the knot and unravel the tangle into which India has woven herself. But the fact that India's *real wealth is in her land* must not be lost sight of; for the more that is made of her vast natural resources the more likely will she be to maintain her proper *status* in the world in the years to come.

Table of Quantities and Value, as far as can be ascertained, of the CHIEF ARTICLES of INDIAN PRODUCE and MANUFACTURE exported from British India

Resins and Gums	cwts.	193,455	167,068	265,808	251,759	196,[illegible]	[illegible]
Salt	"	108,740	7,065	73,060	6,769	73,51[illegible]	[illegible]
Saltpetre	"	415,080	348,949	466,218	381,706	389,002	[illegible]
Seeds, various sorts	total.	10,506,822	5,461,982	9,582,865	5,319,124	12,187,020	[illegible]
Silk raw	lbs.	1,310,569	445,961	1,117,893	776,901	1,512,819	[illegible]
Silk, manufactures of:							
	pieces					170,182	
	yards	2,500,204	240,700	2,301,251	223,00[illegible]	1,535,168	151,080
	dozens					674	
	pounds	3,9[illegible]1		15		1,104	
Soap	cwts.	[illegible]	[illegible]	[illegible]	[illegible]	35,0[illegible]	35,109
Spices	lbs.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Stones, Jade	cwts.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sugar and other saccharine matter	cwts.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tallow		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Tea	lbs.	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	tons	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]							
[illegible]	"	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
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[illegible]			[illegible]		[illegible]		[illegible]
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